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# Fish Health News

A Service to the Field of Fish Health Research

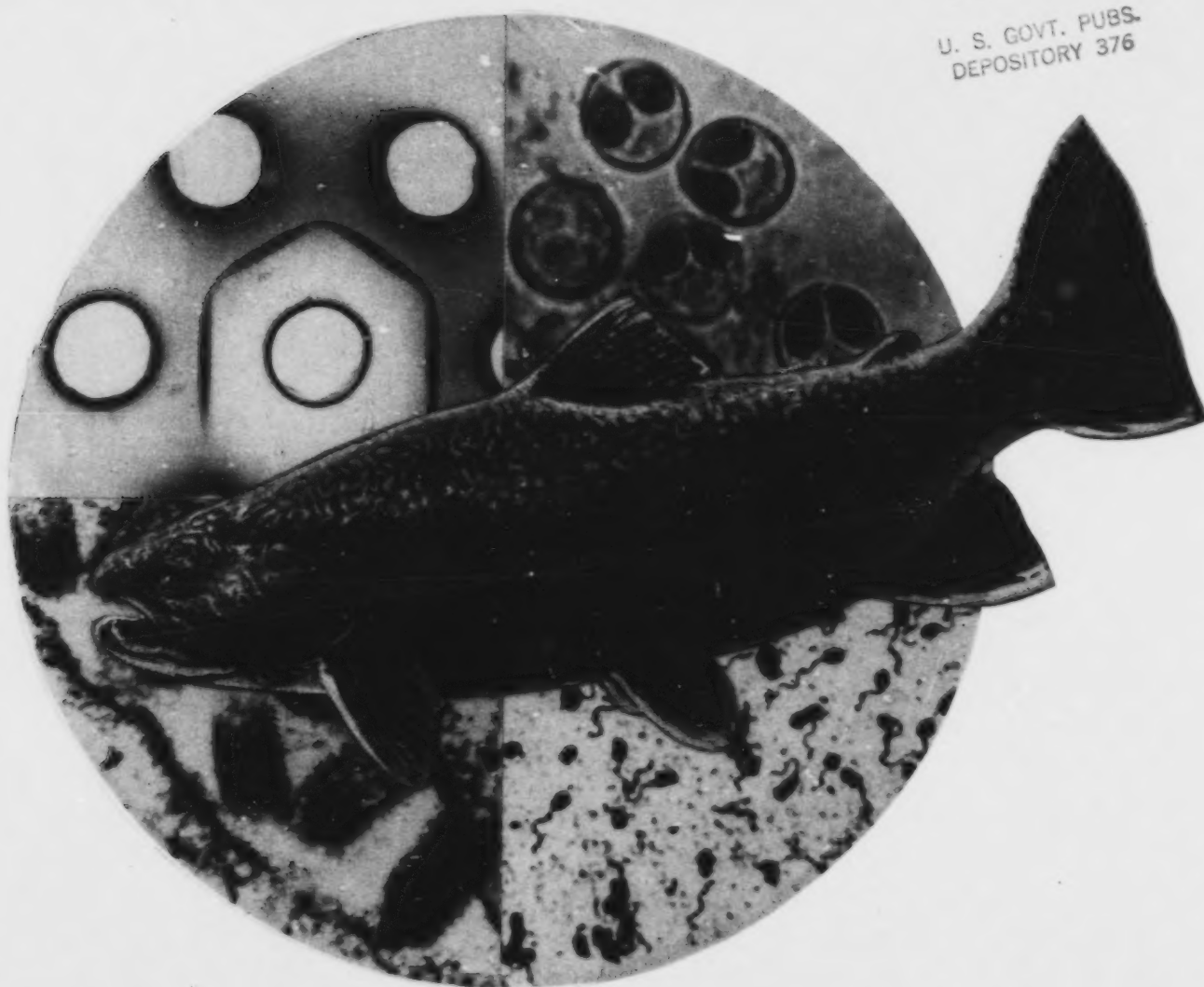
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FISH AND WILDLIFE SERVICE

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# FISH HEALTH NEWS



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Associate Editors Violet J. Catrow  
Blanche Lawson



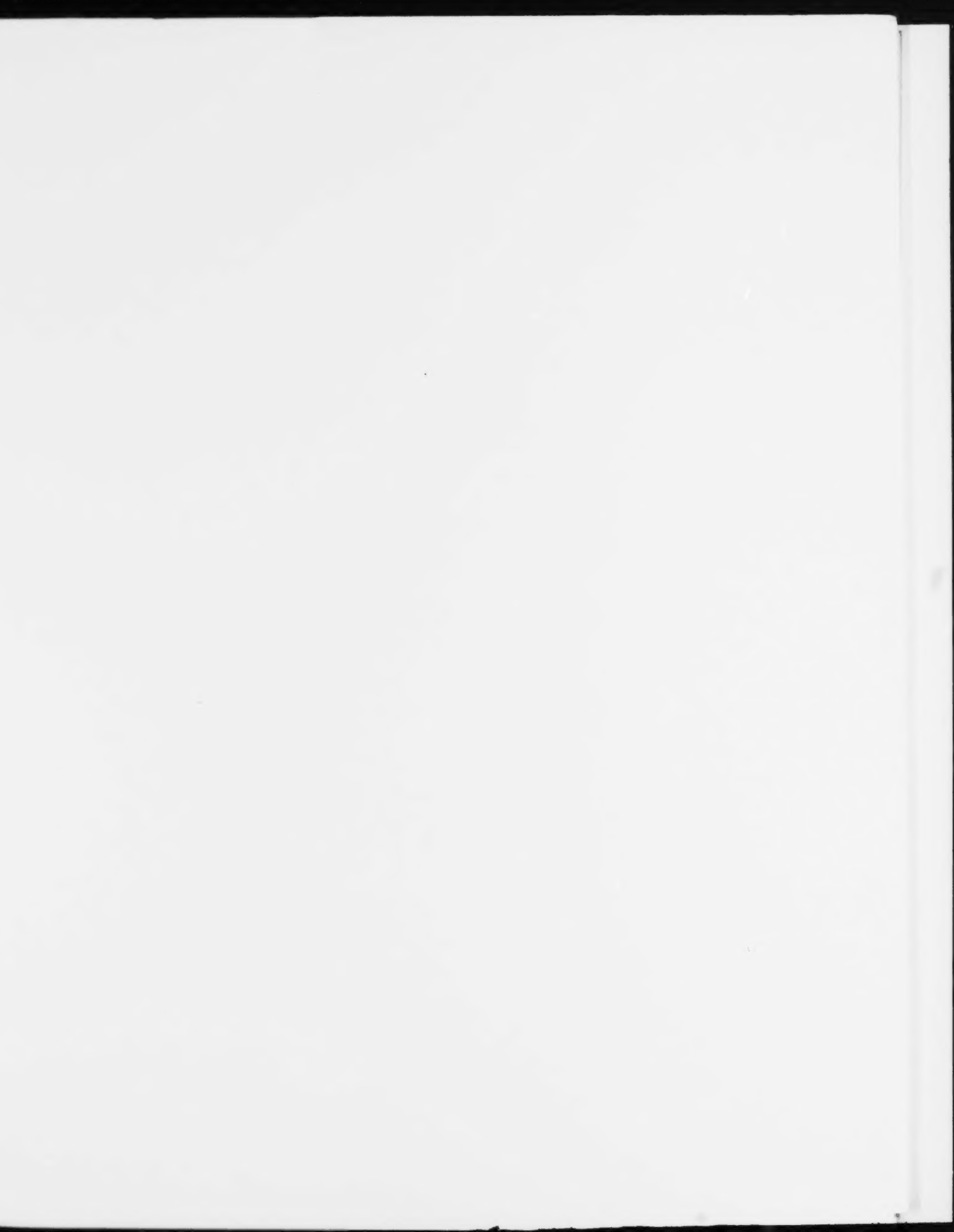
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## EDITORIAL

### FISH HEALTH NEWS

*Fish Health News* is intended to be a service to persons who have an interest in and need for information on fish health and diseases. We recognize that within the broad audience to which the periodical is addressed there are both general and selective readers. Some persons are interested in keeping abreast of their particular specialization, for example, bacteriology or parasitology of fishes. Other readers follow the developments in infectious diseases regardless of the nature of the causal organism.

The virology of fishes is the subject of our comments here. From our particular perspective, the literature on fish viruses and fish virology can be sorted into one or another of two categories. The larger of those categories includes all reports that deal with the relationships within the triad of host, pathogen, and environment. A smaller but rapidly growing category of literature covers reports that are exclusively concerned with biochemical, biophysical, and molecular aspects of the fish virus or viruses themselves. As a matter of policy, we will continue to include the complete references to such works, but the abstracts will be omitted.

We feel obliged to make a change for several reasons. The principal reason for omitting the abstract is that the esoteric details of structure and function of viral molecules is not of prime interest to the majority of our readers. A second reason is that the abstracts of such reports are lengthy and of primary interest to the more sophisticated virologists, biochemists, and molecular biologists. We hasten to add that such persons have other avenues of access to the literature of their specialization. Still another reason is the time, effort, and space required to prepare the copy of such abstracts.

We want to assure our readers that we will continue to prepare *Fish Health News* to be of the greatest value to them and to meet their needs in keeping up with current literature.

We will continue to publish complete abstracts of the characterization and additions to characterizations of fish viruses. Such reports, we believe, are necessary to the proper functioning of persons who work with viruses as agents of fish disease.

## REPORTS

### Influence of Various Dietary Fish Meals on the Growth of Fry of Atlantic Salmon

H. George Ketola  
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U.S. Fish and Wildlife Service  
28 Gracie Road  
Cortland, New York 13045

In the past, Canadian whole herring meal (72% protein) was the protein source of choice for high quality hatchery fish foods. Now, however, Canadian herring meal has a lower protein content (65%) and more ash--two features that are indicative

of by-products (or cuttings) instead of whole herrings. The result is that the nutritive value of the new Canadian herring meal is reduced. Therefore, a nutrition study with fry of Atlantic salmon (*Salmo salar*) was conducted to evaluate

various kinds of fish meals and to compare them with a whole herring meal processed in Norway. The study showed that growth rates of fry fed capelin, whitefish, anchovy, and the new Canadian herring (cuttings) meal (65% protein) were 110, 80, 70, and 70% of that for Norwegian whole herring meal, respectively. The differences in growth response to the various fish meals are important to

understand in order to optimize salmon cultural efforts in times when supplies of the traditional quality fish meals become limited or exhausted and we endeavor to find alternate sources of proteins such as plant proteins and other fish meals that have not previously achieved their maximum potential use in hatchery diets.

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Salmonid Viruses: Effects of *Oncorhynchus masou* Virus (OMV)  
in fry of Chum Salmon (*Oncorhynchus keta*)

Takahisa Kimura, Mamoru Yoshimizu, and Makota Tanaka  
Faculty of Fisheries, Hokkaido University  
Hakodate, Japan

The recently isolated new salmonid virus, tentatively named *Oncorhynchus masou* virus (OMV) (Kimura et al. 1980), has proven to be lethal for 80- to 150-day-old fry of chum salmon (*Oncorhynchus keta*).

One hundred 80-day-old and fifty 150-day-old fry were immersed for 1 h in water at 10°C containing TCID<sub>50</sub>/ml of culture-grown OMV and then held in running water at 10-15°C. Mortality of the younger fry began at 11-12 days post-exposure, and 60% of them succumbed in the ensuing 50 days. On the other hand, mortality of the older fry began at 20 days post-exposure, and 35% of them succumbed in the ensuing 50 days. The cumulative mortality of control fish of each age group was less than 5% during the same period.

The mortality pattern of fifty 150-day-old fry exposed to experimentally infected fry for 2 days was similar to that observed as a result of infection by immersion. However, there were no deaths among 240-day-old chum salmon fingerlings (average body weight 20 g) which were immersed in a suspension of virus and, additionally, injected intraperitoneally with 200 TCID<sub>50</sub>.

Affected fish lost their appetite and some showed exophthalmia or petechiation of the body surface especially under the jaw. Agonal or abnormal swimming behavior was not observed.

Internally, the liver of infected chum salmon fry was mottled with white spots

and, in advanced cases, the color changed to pearly white. In some cases the spleen was swollen, but no obvious changes were found in the kidneys. The digestive tract was devoid of food.

Marked histopathologic changes were seen in liver sections where syncytia were a regular occurrence. Hepatic tissue also showed notable necrosis. In some sections, focal necrosis was present in the spleen, and cardiac muscle was edematous. Pancreatic tissue and kidney tissues were essentially normal.

The liver is perhaps the primary target organ for OMV infection just as it is with *Herpesvirus salmonis* (Wolf et al. 1975).

Electron microscopy of infected liver tissue revealed both empty capsids and nucleocapsids in the nucleus of infected cells, but enveloped particles were scarce.

The fibrillar strands which were reported for *Herpesvirus salmonis* (Wolf et al. 1978) could not be found.

Following experimental infections, OMV was reisolated from all fish that died, and the virus titer was about 10<sup>6</sup> TCID<sub>50</sub>/g of body weight.

From the evidence thus far obtained, OMV is assumed to be a new viral pathogen of salmonids. Furthermore, among the fry that survived experimental infection, more



than 60% developed dermal papillomata, especially on the head. Such lesions appeared during the period of 130 to 200 days post-exposure. It appears, therefore, that OMV is not only virulent, it is also oncogenic. Details of our study of oncogenicity will be given in a later report.

#### REFERENCES

Kimura, T., M. Yoshimizu, and M. Tanaka. 1980. Salmonid viruses: a syncytium-forming herpesvirus from landlocked *Oncorhynchus masou* (OMV). Fish Health News. In press.

Wolf, K., R. L. Herman, R. W. Darlington, and W. G. Taylor. 1975. Salmonid viruses: effects of *Herpesvirus salmonis* in rainbow trout fry. Fish Health News 4(3):8.

Wolf, K., R. W. Darlington, W. G. Taylor, M. C. Quimby, and T. Nagabayashi. 1978. *Herpesvirus salmonis*: characterization of a new pathogen of rainbow trout. J. Virol 27(3):659-666.

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#### Salmonid Viruses: a Syncytium-forming Herpesvirus from Landlocked *Oncorhynchus masou*

Takahisa Kimura, Mamoru Yoshimizu, and Makota Tanaka  
Faculty of Fisheries, Hokkaido University  
Hakodate, Japan

In September 1978 we isolated a previously undescribed virus from ovarian fluids of apparently normal landlocked masu salmon (*Oncorhynchus masou*) at the Otohe Salmon Hatchery, Hokkaido, Japan. The population does not have a history of significant pre-spawning mortality, but the annual survival rate of progeny fry is very low.

At near-optimal incubation at 15°C, the new virus shows distinctive cytopathic effects within 7 to 10 days, i.e., rounded cells, then marked syncytium formation, and eventual lysis of RTG-2, CHSE-214, and KO-6 cells. The FHM and BB cell lines are refractory. Syncytia also show small eosinophilic cytoplasmic inclusion-like bodies. Infectivity of culture-grown virus has been about  $2 \times 10^5$  TCID<sub>50</sub>/ml.

The new virus is heat-, ether-, and acid-labile (pH 3.0), and it is completely inactivated by UV ( $3.0 \times 10^3$   $\mu$ W·Sec·cm<sup>2</sup>). The virus does not hemagglutinate human O+ erythrocytes. Infectivity is preserved at -80°C, but at -20°C 99.9% is destroyed within 17 days. In the absence of host cells complete inactivation occurs at 15 or 20°C in 17 days. Replication occurs at 5 to 18°C but not at 25°C, and at the

optimum temperature of 15°C, peak titer occurs on day 9.

In the presence of 50  $\mu$ g/ml IUDR, replication is inhibited. Infectivity passes serum-treated membrane filters of 450 nm porosity, but it is retained on 220 or 100 nm membranes.

Electron microscopy shows the size of enveloped virions to be 200 X 240 nm. Unenveloped capsids of 115 nm are found either in the nucleus of infected cells or as released forms. The calculated number of capsomeres is 162. Abundant virions bud from the surface of cell membranes.

The above features of the newly recognized virus conforms to the characteristics of the *Herpesvirus* group.

Infectivity of the viral agent was not neutralized by rabbit anti-IPN, -VHS, -IHN, or -*Herpesvirus salmonis* serum.

This new virus is provisionally named *Oncorhynchus masou* virus (OMV).

# A New Viral Disease of Aquarium Fish

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Department of Avian and Aquatic Animal Medicine

and

Ronald C. Riis  
Section of Comparative Ophthalmology  
New York State College of Veterinary Medicine  
Cornell University, Ithaca, New York 14853

We present a description of a new viral disease of the aquarium fish, Ramirez's dwarf cichlid (*Apistogramma ramirezi*). The disease was found in three separate laboratory accessions of three to five fish pools, and each pool represented a separate shipment to a tropical fish retailer. The retailer submitted diagnostic specimens 1 to 3 days after receipt, but because the fish were sick on arrival, the incubation period could not be determined. Following receipt of the fish, the course of the disease extended over a period of 3 to 4 weeks, with 100% morbidity and cumulative mortality ranging from 40 to 80%.

Early in the disease, the most common signs noted were inappetence, generalized paleness, respiratory distress, incoordinated swimming suggestive of weakness, hemorrhages in the skin and iris, and scoliosis. Typically, fish remained stationary with rapid movement of the extended opercula and pectoral fins. As the disease progressed, fish became thin, and degenerative changes of eyes were more pronounced. Just prior to death, opercular movements were slow and shallow; fish were extremely pale and floated passively.

Necropsy frequently revealed an empty contracted gastro-intestinal tract, and a spleen enlarged from three to ten times

normal size. Liver, and kidneys were pale and smaller than normal, but bacterial cultures of the kidneys, liver, and spleen were negative.

Histologic examination of hematoxylin and eosin stained sections revealed degenerative changes in the liver, spleen, kidneys, pancreas, and eyes. Viral inclusion bodies were abundant in the spleen of fish dying early in the course of the disease. Degenerative changes were less common in other organs and in fish dying late in the disease. Cells with inclusions underwent progressive degenerative changes; early stages were characterized by an increase in basophilic staining properties of the entire cell, which became enlarged and filled with a blue amorphous material. Late stages were characterized by cells devoid of cellular contents with the exception of remnants of the nuclear membrane and small round eosinophilic cytoplasmic inclusions.

Electron microscopic examination of splenic cells representative of the early stage of infection revealed viral arrays in a reticulated matrix that filled the cytoplasm. The round eosinophilic inclusion of the late stage was free of viral particles and consisted of poorly defined reticulated material.

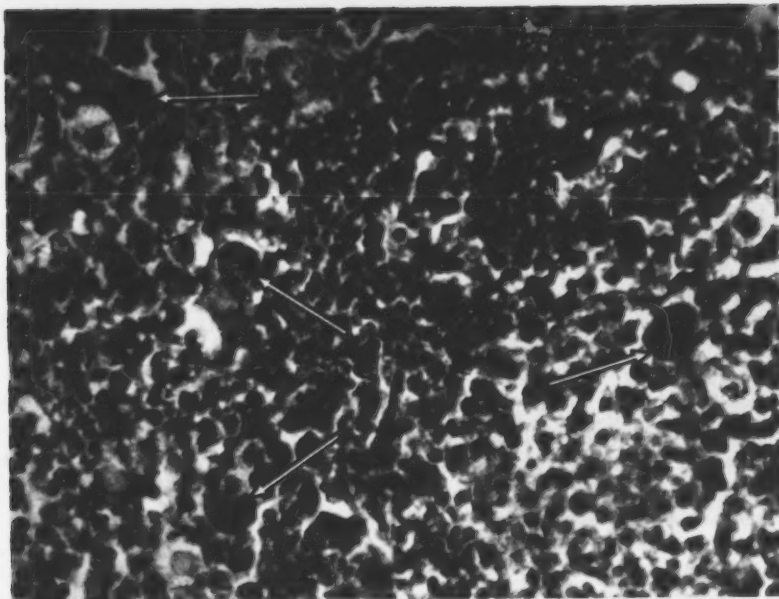


Figure 1. Photomicrograph of a histologic section of a viral infected ram's spleen. Note early cellular changes, characterized by dark (basophilic) staining of the entire irregularly-shaped cells (arrows). X 440.

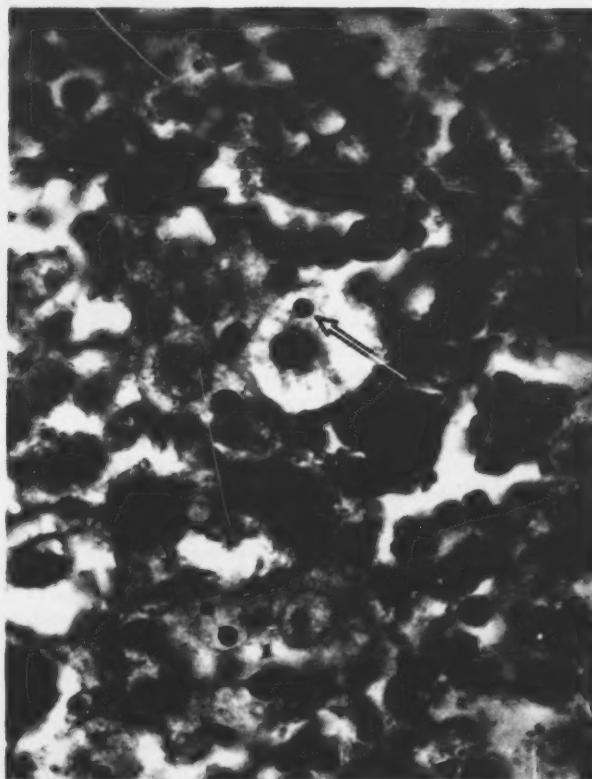


Figure 2. Photomicrograph of histologic section of a viral infected ram's spleen. Note varying stages of cellular degeneration and swelling. The cell in the center is devoid of cytoplasmic content with the exception of a single round (eosinophilic) inclusion body (arrow). X 1040.

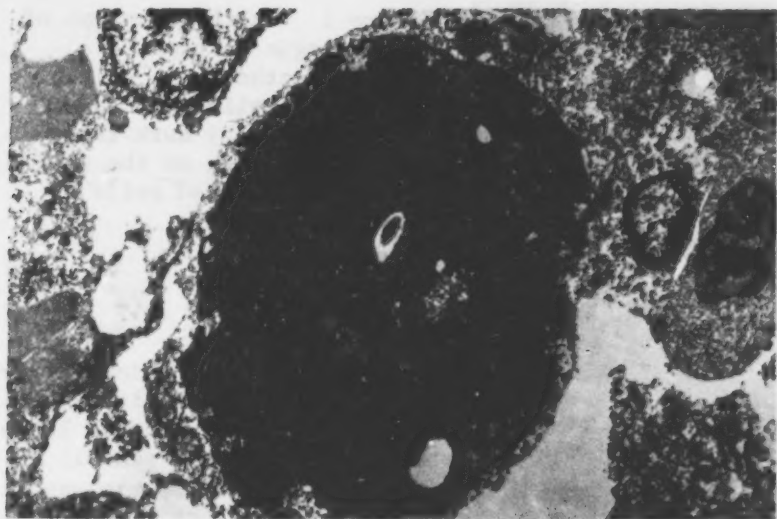


Figure 3. Electron micrograph of swollen irregularly-shaped dark staining cell with viral arrays. X 3192.

Figure 4. Electron micrograph of cytoplasmic viral arrays in infected cell. X 15960.

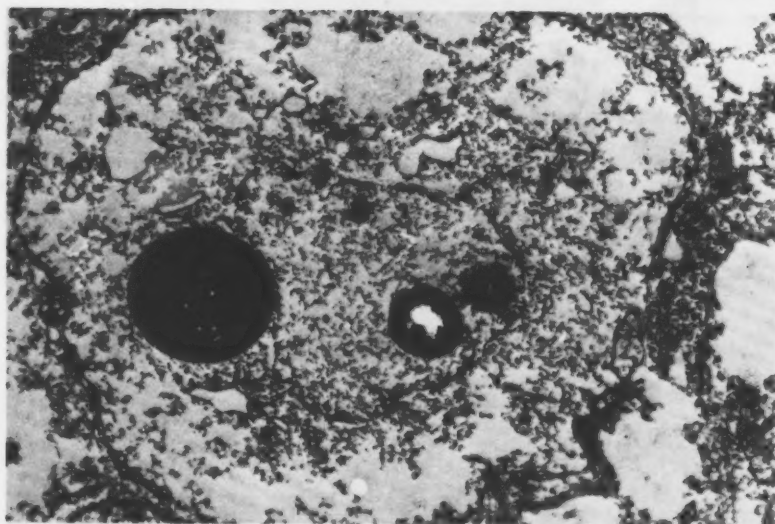
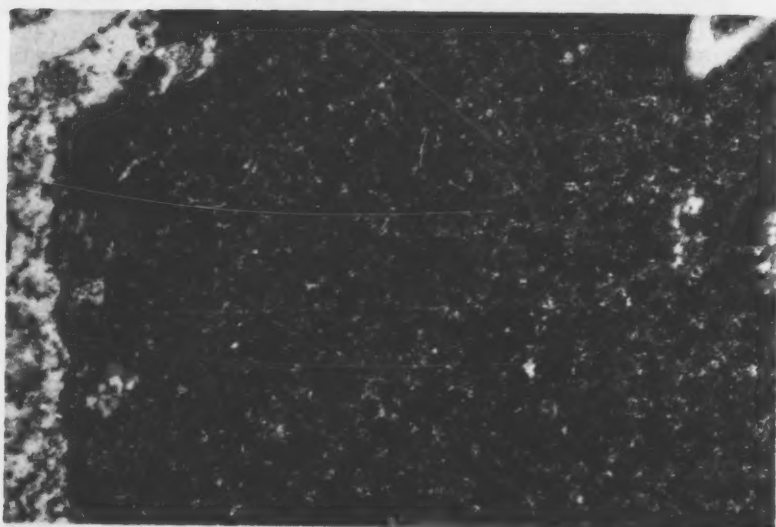


Figure 5. Electron micrograph of late stage of cellular degeneration, characterized by swelling, lack of cytoplasmic contents, with the exception of the single round dark (eosinophilic) cytoplasmic inclusion body. X 6804.



The Taxonomic Position of the Causative Agent  
of Bacterial Kidney Disease

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Corvallis, Oregon 97331

In 1956 Ordal and Earp cultured and subsequently identified the causative agent of bacterial kidney disease (BKD). The agent was considered to be a species of *Corynebacterium*. Smith, in 1964, concluded that Dee disease of salmonids in Scotland and BKD were caused by the same bacterium. In 1978, we presented a paper concerning BKD at the meeting of the Joint 3rd Biennial Fish Health Section and 9th Annual Midwest Fish Disease Workshops held in Kansas City, Missouri. At that time we proposed the name *Corynebacterium salmoninus* but indicated that the bacterium differed markedly from the characteristics described for human and homeotherm pathogenic coryneform bacteria that are listed under the genus *Corynebacterium* in the 8th edition of *Bergey's Manual of Determinative Bacteriology*.

Subsequently, a manuscript describing the characteristics of the BKD bacterium was submitted to the *International Journal of Systematic Bacteriology*. The referees and editor of that journal agreed that the BKD organism did not belong in the genus *Corynebacterium*, and suggested that a new genus be established. Accordingly, we proposed the name *Renibacterium salmoninarum*.

A manuscript entitled *Renibacterium salmoninarum* gen. nov., sp. nov., the Causative Agent of Bacterial Kidney Disease in Salmonid Fishes appeared in the April 1980 issue of the *International Journal of Systematic Bacteriology*. Reprints may be obtained from J. L. Fryer.

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## BOOK REVIEWS

Brown, E. E., and J. B. Gratzek. 1980.  
Fish farming handbook. Food, bait,  
tropicals and goldfish. AVI Publishing Company, Inc., Westport,  
Connecticut. 391 pp.

Fish farming has a long history, for it has been practiced for centuries in the Far East and in Central Europe. Fish are also recognized in art, history, and religion. In contrast, modern fish farming has a history dating back only about one century, and that of scientific fish culture is even shorter. The first fisheries experimental station was established near Munich, Germany, early in the 20th century. The explosive growth of pondfish culture in the United States started in the 1950's. Large-scale culture of salmonids in salt-water enclosures for human consumption is of still more recent origin--a matter of decades.

In North America, warm-blooded vertebrates remain the principal source of animal protein, and cultured pondfish or saltwater fish are consumed on a lesser scale. Nevertheless, there is considerable interest in expanding the culture of food fish. The culture of bait and ornamental fish is another area of profitable fish production in the United States.

Brown and Gratzek's handbook deals with fish culture as it is practiced in the United States. Several textbooks on world fish culture have been published during recent years, among them is *World Fish Farming* by E. E. Brown, the senior author of the handbook.

The *Fish Farming Handbook* is intended for practical fish-culturists and those interested in entering fish culture as a business. The culture of catfish, bait, goldfish, tropical fishes, trout, and salmon

is described in greater detail. Culture of five species of Pacific salmon is only briefly mentioned, because it is an extension of trout culture. While no market exists for eels in the United States, they are considered a delicacy in other countries. Eels are abundant in the United States; therefore, the authors describe how larval eels are captured and propagated to export market size. Bigmouth buffalo, tilapia, and goldfish culture are mentioned briefly.

There are separate chapters on the role of environmental factors in fish culture, construction and maintenance of ponds, nutrition and feeding, and processing and marketing.

Chapter 7, "Common Fish Diseases and Their Control," is the largest and most detailed chapter. With increased intensity of fish culture, diseases have proven to be a limiting factor in production. Therefore, good fish-culturists should be able to recognize the most important diseases and how they may be prevented and controlled. Detailed information is given on examination and dissection of fishes, and on those disease signs that aid in presumptive diagnosis. Drawings and electron micrographs of selected parasites and bacteria are excellent; however, the electron micrographs of parasites and bacteria have been poorly reproduced. Precise identifications of bacterial and viral diseases are not discussed because they require advanced training and expensive laboratory facilities.

Many drugs and chemicals are listed for treatment of fish diseases; however, some are considered harmful to man or to the

environment. Therefore, in some countries the use of such compounds for treatment of food fishes is regulated by law.

Proper use of drugs is not a simple matter. Most of the drugs and chemicals used in control of fish diseases have a narrow margin of safety and efficacy--an excess may be toxic, and too little may be ineffective--therefore, dosage and duration must be appropriate. Not all substances listed as antibiotics (pp 333-335) are actually antibiotics. Table 7.3 is furnished to facilitate calculation of the quantity of chemicals to be added to water. In some cases however, use of the table is not practicable. For example, the last line of Table 7.3 indicates that as little as 0.0000623 pound of any substance has to be added to 1 cubic foot of water to obtain a solution containing 1 ppm. The calculation is correct, but I do not believe that it has any practical value.

The authors use a style that is lucid and concise and a detailed index is of great help in locating information.

References at the end of each chapter are limited to essentials. "Recommended Reading" is also included for those interested in additional information.

This book is a welcome addition for fish-culturists, fishery biologists, and administrators.

--S. F. Snieszko

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Neish, G. A., and G. C. Hughes. 1980. Fungal diseases of fishes, Book 6, (159 pp) in S. F. Snieszko and H. R. Axelrod, eds. Diseases of fishes. T.F.H. Publications, Inc., Neptune, New Jersey.

Another volume, Book 6 *Fungal Diseases of Fishes*, has appeared in the series on *Diseases of Fishes*, and like the preceding volumes of the series, it is destined for

wide distribution. At the time of publication the books contain the best scientific information available; they are intended for comparative pathologists, veterinarians, fish pathologists, fishery biologists, as well as for practical fish-culturists. The aim is to inform the reader in a lucid and meaningful manner about diseases, their prevention and treatment.



The latest volume should be a revelation to many fishery workers who usually do not hear much about fungal infestations of fishes except those caused by *Saprolegnia*. *Saprolegnia* is used indiscriminately to describe fungi which can destroy eggs in incubators, or which invade, secondarily, lesions caused by other agents and physical injury.

The book describes six groups of "fungi" that have been reported from diseased freshwater and marine fishes. Of these six groups OOMYCETES, BRANCHIOMYCES, FUNGI IMPERFECTI, and ASCOMYCETES are recognized as true fungi. The taxonomic position of two other groups, *ICHTHYOPHONUS* and *DERMOCYSTIDIUM*, important fish pathogens, is still uncertain. It is possible that they may belong to parasitic protozoans.

Fishery biologists probably recognize OOMYCETES readily because *Saprolegnia* and *Achlya*, common parasites of fishes and fish eggs belong in the group.

The text is organized so that all the important information is included in the

description of each of the six groups. Descriptions include morphology, taxonomy, historical background, epizootiology, pathology, identification, and methods of control.

The book is well illustrated with drawings as well as black and white and color photographs. A large bibliography contains 426 references of domestic and foreign reports, and an index is included.

It is striking that so little information exists on prevention and treatment of fungal diseases. Very few chemicals are recommended and malachite green, considered to be the most effective, is unsafe for fishes and people.

Volume 6 should be in the library of every one interested in the culture of fishes and management of fisheries. The work is also important to aquarists, producers, and handlers of ornamental fishes.

--S. F. Snieszko

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Reichenbach-Klinke, H. H., editor. 1980. Fish and Environment (Fisch und Umwelt). Contributions to fish pathology and fish toxicology (Beitrag zur Fischpathologie und -toxikologie). Vol. 8. Gustav Fischer Verlag, Stuttgart and New York. 156 pp.

The volume consists of contributed papers marking the 65th birthday of Professor Reichenbach-Klinke, on 14 August 1979.

Papers are in English or German but each has an English and a German summary.

Abstracts of individual papers are listed by Author in this issue of *Fish Health News*.

--S. F. Snieszko

## ITEMS OF INTEREST

### Another Recognition for the Leetown Fisheries Laboratory

S. F. Snieszko, former director of the Eastern Fish Disease Laboratory (renamed National Fish Health Research Laboratory), was elected as an honorary member of the European Association of Fish Pathologists in 1979.

The new organization includes fish pathologists from all countries of western Europe, some from eastern Europe, Japan, and North America. The President of the association is N. O. Christensen, Denmark; the Vice-President is B. J. Hill, United Kingdom; and the General Secretary is H. J. Schlotfeldt, Federal Republic of Germany.

The first three people elected to honorary membership are O. N. Bauer, Leningrad, USSR; W. Schäperclaus, Berlin, German Democratic Republic; and S. F. Snieszko, Leetown, West Virginia, USA.

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### CHILEAN SALMON PROGRAM

Chile's program of successful establishment of runs of Pacific salmon in coastal streams south of Puerto Montt and in the area of Punta Arenas has generated national and international interest. As part of that program, Dr. John L. Fryer and Tony Amandi, Oregon State University, held a 2-week course on fish diseases during March 10-21, 1980. Twenty-four biologists, fisheries workers, microbiologists, and veterinarians attended the lectures and laboratory sessions.

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### FISH PATHOLOGIST'S CERTIFICATION

The Professional Standards Committee and the Executive Committee of the Fish Health Section of the American Fisheries Society have completed all the required reviews for a procedure to certify fish pathologists. The approved program is detailed in the July-September 1979 issue of the *Fish Health Section Newsletter*. For more information, contact Dave McDaniel, Board of Certification, Fish Health Section/AFS, Rt. 1, Box 31A, Shepherdstown, West Virginia 25443.

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### PARASITE IDENTIFICATION SERVICE

We have been advised by the Commonwealth Institute of Helminthology, The White House, 103 St. Peter's Street, St. Albans, Herts., England, AL1 3EW that they offer free animal helminth identification service to noncommercial concerns in the United Kingdom and Commonwealth. Quotations for charges for work from outside the Commonwealth can be obtained on request.

## DOMESTIC INSPECTORS TITLE 50, CFR

The United States Fish and Wildlife Service is updating the list of authorized domestic inspectors for Part 16.13, Title 50, Code of Federal Regulations. These regulations state that all shipments of live or dead fish or eggs of the family Salmonidae are prohibited entry into the United States for any purpose unless such importations are by direct shipment, accompanied by a certification that the importation is free of the protozoan *Myxosoma cerebralis*, the causative agent of so-called "whirling disease" and the virus causing Viral Hemorrhagic Septicemia (VHS) or "Egtved disease." The certification shall be signed by a qualified fish pathologist so authorized and designated by the Secretary of the Interior.

All presently authorized inspectors will be asked if they wish to remain on, or to be removed from, the list. The inquiry also will ask if inspectors have or have not been working in the field of fish health as domestic inspectors for Title 50, CFR for the past year. Inspectors for Title 50, CFR will be contacted annually in order to maintain a current listing of their names.

If you are on the list of designated fish pathologists (inspectors) and have not received the form letter inquiry, please notify the Chairman of the Technical Advisory Group (TAG), Title 50 Committee, no later than 1 March 1981.

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## CALL FOR PAPERS FOR 1981 ANNUAL MEETING OF THE FISH HEALTH SECTION/AFS AND EASTERN FISH DISEASE WORKSHOP

The 1981 Annual Meeting of the Fish Health Section/American Fisheries Society and the 6th Eastern Fish Disease Workshop will be held jointly on July 21-22, 1981 at Mississippi State University, Starkville, Mississippi.

Contributed papers of a practical nature on disease treatments, diagnostic procedures, and problems with infectious and noninfectious diseases are preferred. Contributed papers should be limited to 15 minutes. Persons interested in presenting a paper should submit an abstract, not to exceed two pages typed double-spaced on white bond paper (8½ x 11 inches). Abstracts of papers must be submitted by February 1, 1981 to: Thomas L. Wellborn, Jr., Leader, Extension Wildlife and Fisheries, P. O. Box 5405, Mississippi State, Miss. 39762. Telephone 601/3253174.

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## LIBRARY ACCESSIONS

000001

Agius, C.

1979. The role of melano-macrophage centers in iron storage in normal and diseased fish. *J. Fish Dis.* 2(4):337-343. (Unit Aquatic Pathobiol. Univ. Stirling, Stirling FK9 4LA, Scotland.).

The spleen, kidney and liver melano-macrophage centers of 14 species of clinically normal teleost fish were examined histochemically for ferric iron. Iron was present in varying amounts within the splenic centers of most specimens, but by contrast it was rarely found in the centers of the kidney and the liver.

Under conditions of starvation and in diseased fish, a markedly increased deposition of ferric iron occurred in the splenic centers of nearly all fish examined. By comparison, the iron content in the kidney and liver centers was generally still very low. These results suggest that there exist important functional differences between the pigment centers of different hemopoietic tissues of teleosts. (Author). 000526.

000002

Ahne, W.

1979. Fish cell culture: a fibroblastic line (PG) from ovaries of juvenile pike (*Esox lucius*). In *Vitro* 15(11):839-840. (Inst. Zool. Hydrobiol. Univ. Munich, Fed. Rep. Germany.).

The PG cell line at 2.5 years of age and 51st passage was found to grow at temperatures of 4 through 25 C but not at 28 C and higher. The modal chromosome number was 48 and about one-fourth of the cells were aneuploid. The line replicated Egtved, IPN, SVC, and PFR viruses with easily seen CPE. The line is free of mycoplasma contamination. (Ken Wolf). 000536.

000003

Amin, O. M., Burns, L. A., Redlin, M. J.

1980. The ecology of *Acanthocephalus parksidei* Amin, 1975 (Acanthocephala: Echinorhynchidae) in its isopod intermediate host. *Proc. Hel-*

minthol. Soc. Wash. 47(1):37-46. (Sci. Div. Univ. Wisconsin-Parkside, Kenosha, Wis. 53141.).

The isopod intermediate host of *Acanthocephalus parksidei* Amin, 1975 in the Pike River in southeastern Wisconsin, *Caecidotea militaris* (Hay), appears to have one major breeding season in the late spring-early spring-early summer. Cystacanth infections and developmental cycle were closely related to that of its host with initiation of recruitment in the summer following a peak adult *A. parksidei* reproduction in its fish hosts during the spring. Prevalence markedly increased beginning from July, but decreased somewhat toward the spring, possibly affected, at least in part, by parasite-induced mortality of multiply infected hosts. Cystacanth size increased with season and host size. Frequency of infection was higher in male than in female isopods; juveniles and gravid females were never infected. Sex ratio was 1 male:1.6 females. No significant association between parasitism and host depigmentation was observed. It is concluded that an *A. parksidei* generation has a seasonally well-defined life cycle of 1 year in both intermediate and definitive hosts, with a limited degree of carry-over. Cystacanths are shown to be more commonly over-dispersed in their isopod hosts; the negative binomial or truncated negative binomial distributions are the best descriptive patterns in three of five monthly samples analyzed. Regulation of isopods multiply infected with cystacanths (death rate of >0.50) during early spring is indicated. (Authors). 000539.

000004

Amlacher, E., Ude, J., Rudolph, C., Ernst, G.

1980. Direct electron microscopical visualization of the presumptive virus of viral hemorrhagic septicemia (VHS) in the rainbow trout *Salmo gairdneri* Richardson and additional histopathological and hematological observations. *J. Fish Dis.* 3(1):55-62. (Inst. Pathol. Dep. Electron Microsc. Univ. Jena, Dem. Rep. Germany.).

Electron microscopical and histopathological investigations were carried out on the anterior kidney of 10 1-year-old farmed rainbow trout naturally infected with the external signs of viral hemorrhagic septicemia (VHS). The histopathology of the liver and the hematology of peripheral blood



were also examined. The presumptive virus of VHS was directly demonstrated for the first time in the anterior kidney.

All diseased fishes showed necrotic changes in the kidney and the liver. The melano-macrophage centers of the anterior kidney showed a partial destruction accompanied with a loss of melanin. A progressive destruction of the erythrocytes was observed. The liver exhibited moderate to extensive necrosis (karyorrhexis and karyolysis with lymphocytic invasion in the necrotic areas). Neither intranuclear nor intracytoplasmic inclusions were observed. In the peripheral blood diverse stages of erythrocytic degeneration, amitoses of the erythrocytes and a five-fold increase in lymphocyte numbers were observed. (Authors). 000555.

000005

Andersen, K.

1979. Studies on the scolex morphology of *Eubothrium* spp with emphasis on characters usable in species discrimination and with brief references on the scolices of *Bothriocephalus* sp and *Triaenophorus* spp (Cestoda; Pseudophyllidea). Z. Parasitenkd. 60:147-156. (Univ. Oslo, Zool. Mus. Sars gt. 1, Oslo 5, Norway.).

Scolices of *Eubothrium crassum* from brown trout, *E. salvelini* from char, *E. parvum* from mal-lotus, *Bothriocephalus* sp from three-spined stickle-back, and *Triaenophorus* spp from pike were studied using scanning electron microscopy (SEM) and light microscopy, only the two first mentioned species were sectioned for transmission electron microscopy (TEM). All scolices examined with SEM were characterized by 'spherical bodies' appearing on the scolex surface. Studied with TEM these 'bodies' turned out to be cytoplasmic protrusions containing secretory granules. These protrusions seemed to be nipped off as globular structures which freed single secretory granules.

The present study also emphasizes the use of SEM as a tool in cestode taxonomy and clarifies some of the problems and confusion that have surrounded the scolex morphology and shape of *E. crassum* and *E. salvelini*. (Author). 000612.

000006

Barham, W. T., Schoonbee, H., Smit, G. L.

1979. The occurrence of *Aeromonas* and *Streptococcus* in rainbow trout, *Salmo gairdneri* Richardson. J. Fish Biol. 15(4):457-460. (Dep. Zool. Rand Afrikaans Univ. P. O. Box 524, Johannesburg 2000, Rep. South Africa.).

Smears were taken from the eyes, spleen and blood from rainbow trout collected from a fish farm and classified as clinically sick, under treatment, recovered and apparently healthy. The smears were examined microscopically and the bacteria present identified as *Aeromonads* or *Streptococci*. The results indicated a high incidence of *Aeromonads* in the eye and the spleen but not in the blood in all groups including those apparently healthy, while *Streptococci* were present in the blood as well as the eye and the spleen. (Authors). 000516.

000007

Berra, T.M., Au, R.-J.

1978. Incidence of black spot disease in fishes in Cedar Fork Creek, Ohio. Ohio J. Sci. 78(6):318-322. (Dep. Zool. Ohio State Univ. Mansfield Campus, Mansfield, Ohio 44906.).

A total of 4175 fishes belonging to 29 taxa in six families were examined for black spot disease. Of that total, 89 per cent were infected with one or more metacercariae of the strigeid fluke, *Uvulifer ambloplitis*. *Rhinichthys atratulus*, *Semotilus atromaculatus* and *Camptostoma anomalum* had the highest incidence of infection and the greatest number of individual parasites. Other pool-dwelling minnows such as *Notropis cornutus* and *Pimephales notatus* were also heavily infected, whereas *Notropis photogenus*, which prefers deep, swift riffles, had very few cysts. The only nonminnows to approach the high totals of the pool-dwelling cyprinids were *Catostomus commersoni* and *Etheostoma nigrum*. *Hypentelium nigricans*, which prefers faster water than *Catostomus* and three species of *Etheostoma*, which, unlike *E. nigrum*, are riffle dwelling forms, also had lower incidences of infection and fewer cysts. *Cottus bairdi*, another rapid water species, did not develop black spot disease. Only one specimen of 225 *Ericymba buc-cata*, which occur over shifting, sandy bottoms, had a single cyst. Our data suggest that the species which inhabit the slower flowing waters of a stream are likely to be more heavily infected than their relatives which prefer faster water because snail hosts are absent and any cercariae present are more likely to be swept away in rapid water and thus have less of a chance to penetrate a host. (Authors). 000611.

000008

Bhaibulaya, M., Indra-Ngarm, S., Anantha-pruti, M.

1979. Freshwater fishes of Thailand as experimental intermediate hosts for *Capillaria philippinensis*. Int. J. Parasitol. 9:105-108. (Dep. Helminthol. Fac. Trop. Med. Mahidol Univ. 420-6, Rajvithi Road, Phyathai, Bangkok 4, Thailand.).

Nine species of freshwater fishes from Thailand have been exposed to infection with embryonated eggs of *Capillaria philippinensis*. The eggs were fed to fishes with food or through a polyethylene tube. After 10-30 days larvae capable of establishing intestinal capillariasis in Mongolian gerbils were recovered from six fish species: *Cyprinus carpio*, *Puntius gonionotus*, *Aplocheilichthys panchax*, *Gambusia holbrooki*, *Rasbora borapetensis*, and *Trichopsis vittatus*. Larvae were not recovered from *Tilapia nilotica*, *Osteochilus hasseltii* and *Trichogaster trichopterus*. Five human cases of intestinal capillariasis have been reported from widely scattered areas of Thailand and the natural intermediate and definitive hosts remain to be determined. (Authors). 000620.

000009

Bortone, S. A., Bradley, W. K., Oglesby, J. L.

1978. The host-parasite relationship of two copepod species and two fish species. J. Fish Biol. 13(3):337-350. (Fac. Biol. Univ. West Florida, Pensacola, Fla. 32504.).

A total of 2494 *Menidia beryllina* and 717 *M. peninsulae* (Atherinidae) were examined from the Pensacola Bay area for parasitic copepods. *Menidia peninsulae* was infested with *Bomolochus concinnus* (Bomolochidae) and *Ergasilus manicatus* (Ergasilidae) and had incidences (and intensities) of 12.3 per cent (1-6) and 4.2 per cent (1-3), respectively. Only seven *M. peninsulae* were infested with both species of parasites. *Menidia beryllina* was infested only with *E. manicatus* and showed different incidences (and intensities) in two areas: Mulatto Bayou, 13.2 per cent (1-9); Catfish Basin, 53.0 per cent (2-3). Fishes with parasites were significantly longer than fishes without parasites and the case of increasing number of parasites with increasing fish length was reinforced. *Bomolochus concinnus* is a warm water parasite on *M. peninsulae* while *E. manicatus* acts as a cold water parasite on *M. peninsulae* and a warm water parasite on *M. beryllina*. The parasites tended to be overdispersed on their hosts but at the same time showed evidence of negative intraspecific associations within a host. These data suggest intraspe-

cific avoidance by the parasite but active acquisition by the host. (Authors). 000520.

000010

Boyce, N. P.

1979. Effects of *Eubothrium salvelini* (Cestoda: Pseudophyllidae) on the growth and vitality of sockeye salmon, *Oncorhynchus nerka*. Can. J. Zool. 57(3):597-602. (Dep. Fish. Environ. Fish. Mar. Serv. Resour. Serv. Branch, Pacific Biol. Stn. Nanaimo, B.C. Canada V9R 5K6.).

Sockeye salmon (*Oncorhynchus nerka*) fry infected experimentally with the cestode *Eubothrium salvelini*, as well as noninfected controls, were studied in the laboratory for approximately 1 year through their development to the smolt stage. Fish were weighed and measured at 10-day intervals and tested for stamina in an active capacity tunnel. Parasitism had a deleterious effect on the growth, survival, and swimming performance of the fish. (Author). 000505.

000011

Braun, F.

1974. The swimbladder inflammation of carp (SBE). (Die Schwimmblasenentzündung der Karpfen (SBE).) Muench. Beitr. Abwasser-Fisch-Flussbiol. 25:69-74. (Zool. Parasitol. Inst. Univ. Munich, Fed. Rep. Germany.).

The contagious nature of swimbladder inflammation (SBE) has been recognized for 50 years.

In addition to other symptoms, the disease is characterized by a progressive inflammatory process in the walls of the swimbladder, head standing, and swelling of the posterior portion of the body cavity.

Distinct features of SBE and infectious dropsy are mentioned.

Because it is not possible today to achieve reliable control of SBE with drugs, prophylactic measures must be taken. For that purpose, suggestions are submitted. (Ken Wolf). 000588. (Paper in German)

000012

Brooks, R. E., McArn, G. E., Wellings, S. R.

1969. Ultrastructural observations on an unidentified cell type found in epidermal tumors of

flounders. J. Natl. Cancer Inst. 43(1):97-109. (Dep. Pathol. Univ. Oregon Med. Sch. Portland, Ore. 97201.).

The ultrastructure of an unknown cell type found in skin tumors of flounders is illustrated and described. The unknown cell is characterized by membrane-bound, pleomorphic, cytoplasmic granules, large mitochondria with small, round cristae, and prominent nucleoli. This cell type appears in both the stromal and epidermal portions of the tumors. Some of these unknown cells have an extracellular cell coat relatively thick, about 500 Å, on cells in the stroma, but, when present on cells in the epidermis, less than one-half that thickness. In the stroma, the unknown cells frequently occur in closely connected pairs and occasionally as linked triplets or quadruplets. The unknown cell is morphologically different from any cell found in normal fish epidermis or dermis. The possibility that this cell is an altered fish cell or a unicellular parasite of unknown type is discussed. (Authors). 000604.

000013

Bullock, G. L., Griffin, B. R., Stuckey, H. M.

1980. Detection of *Corynebacterium salmoninus* by direct fluorescent antibody test. Can. J. Fish. Aquat. Sci. 37(4):719-721. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Kearneysville, W. Va. 25430.).

A direct fluorescent antibody test (FAT) was developed for detecting *Corynebacterium salmoninus*, causative agent of bacterial kidney disease. The direct procedure was found to be as specific as the previously described indirect test, and requires only 7 min—about one-twentieth as much time—to perform. A comparison of the direct FAT with the gram stain for sensitivity of detecting the bacterium indicated the fluorescent procedure to be 100 to 1000 times more sensitive. Furthermore, the FAT is highly effective and efficient for screening large numbers of samples. (Authors). 000518.

000014

Bulow, F. J., Winningham, J. R., Hooper, R. C.

1979. Occurrence of the copepod parasite *Lernaea cyprinacea* in a stream fish population. Trans. Am. Fish. Soc. 108(1):100-102. (Dep. Biol. Tennessee Tech. Univ. Cookeville, Tenn. 38501.).

Although *Lernaea cyprinacea* is often an epizootic in lakes, ponds, and hatcheries, its occurrence

and intensity of infection in a central Tennessee stream system were quite low. Ten of the 13 species of fish collected in the Blackburn Fork watershed (Tennessee) were infected and intensity of infection was highest during the warmest of the seasons. There was also a tendency for the rate of infection to be higher in fish from smaller streams. Adult female *L. cyprinacea* showed a definite affinity for attachment to the host fish body near the base of a fin. (Authors). 000499.

000015

Carrick, T. R.

1979. The effect of acid water on the hatching of salmonid eggs. J. Fish Biol. 14(2):165-172. (Freshw. Biol. Assoc. The Ferry House, Far Sawrey, Ambleside, Cumbria, England.).

The survival of salmon *Salmo salar*, sea trout and brown trout *Salmo trutta* eggs in acid water in the range pH 3.5 to 7.0 was investigated over a period of three winters. The effects of fertilizing the eggs in acid water at pH 4.0, 4.5 and 5.0, and dilution of the test media were also studied. There was considerable yearling variation in the numbers of eggs which hatched, but there were no marked differences between the three species in the tolerances of the eggs to acid water; pH 3.5 was lethal within 10 days to all the eggs, but at pH 4.5 and higher pH levels there was no obvious difference in hatching attributable to acidity. (Author). 000545

000016

Cone, D. K.

1979. The oncomiracidium of *Urocleidus adspectus* Mueller, 1936 (Monogenea: Ancyrocephalinae). Can. J. Zool. 57(5):1098-1103. (Dep. Biol. Univ. New Brunswick, Fredericton, N. B. Canada E3B 5A3.).

The oncomiracidium of *Urocleidus adspectus* Mueller, 1936 (Monogenea: Ancyrocephalinae) is described and compared with others. Its body is fusiform to pyriform in shape and measures approximately 30 by 75 µm. Sixty-one ciliated locomotory cells are arranged into four zones: an anterior zone with 27 cells; two ventrolateral zones, each with 10; and a posterior zone with 14 cells. An undetermined number of small argyrophilic sensilla occur anteroventrally on the head and 46 (34 dorsal and 12 ventral) large argyrophilic sensilla are on the body and haptor. Four pigmented eyes, 10 flame cells, lipid droplets, and a gut are present. Ten to 12 lateral and 2 median gland cells



empty on the prohaptor and 4 posterior gland cells empty on the haptor. Fourteen marginal hooks (10 lateral, 2 posterior, 22 posterior, 2 ventral) occur in the haptor, and rudiments of the hamuli are not present. (Author). 000512.

000017

Cone, D. K.

1979. Hatching of *Urocleidus adspectus* Mueller, 1936 (Monogenea: Ancyrocephalinae). Can. J. Zool. 57(4):833-837. (Dep. Biol. Univ. New Brunswick, Fredericton, N.B. Canada E3B 5A3.).

Eggs of *Urocleidus adspectus* Mueller, 1936 hatched in 5-6 days at 20 C. Oncomiracidia dislodged the operculum mechanically and emerged head first through the opercular opening. Lateral and median head glands were not involved in hatching and the size of eggs did not change during incubation. Oncomiracidia developed and hatched when incubated undisturbed in total darkness and were not stimulated to hatch when exposed to fresh perch mucus. Swelling of fluid-filled sacs appeared to aid in oncomiracidial emergence. (Author). 000511.

000018

Cone, D. K.

1979. *Henneguya doori* Guilford, 1963 (Myxosporida) of *Perca flavescens* in New Brunswick. Can. J. Zool. 57(9):1785-1788. (Dep. Biol. Univ. New Brunswick, Fredericton, N.B. Canada E3B 5A3.).

Of the *Perca flavescens* collected during winter from Little Magaguadavic Lake, New Brunswick, 34 per cent were infected with *Henneguya doori* Guilford, 1963. Cysts were on the primary gill lamellae and formed white nodules (0.5 to 0.9 mm in size) that contained dense masses of mature spores. Most cysts were in septal tissue near the afferent artery (inflowing blood) and a few were in secondary lamellae. Cysts were absent from septal tissue that surrounded the efferent artery (outflowing blood). This distribution suggests that infective trophozoites enter the primary gill lamellae via the afferent artery and then migrate through the endothelium and develop in the septal tissue. Some infective trophozoites appear to enter secondary lamellae but possibly because of the small diameter of the capillaries do not reach the efferent artery and thus develop in the capillary bed.

Mature spores found in the present study are morphologically similar to spores of *H. doori* de-

scribed from Lake Michigan. *Henneguya doori* occupies the same tissue in the same host species as *Henneguya percae* Fantham, Porter, and Richardson, 1939, and spores of the two species have some morphological similarities. It is concluded that *H. doori* may be a synonym of *H. percae*. (Author). 000494

000019

Cone, D. K.

1979. Development of the haptor of *Urocleidus adspectus* Mueller, 1936 (Monogenea: Ancyrocephalinae). Can. J. Zool. 57(10):1896-1904. (Dep. Biol. Univ. New Brunswick, Fredericton, N.B. Canada.).

*Urocleidus adspectus* Mueller, 1936 (Ancyrocephalinae) was transmitted experimentally to *Perca flavescens* and development of its haptor studied at 20 C.

The oncomiracidial haptor unfolds into a ventrally directed disc with 14 marginal hooks. Hamulus rudiments appear in multinuclear oncoblasts lying immediately anterior to the larval disc. The four oncoblasts move into the disc in synchrony and rudiments develop into blades. Five days postinfection, when most larvae were found on the gills, the disc is differentiating into the haptor of adult worms. The tissue enclosing the partially developed blades of the hamuli initially projects from the posteroventral surface of the haptor; tips of the ventral blades point anteriorly or anteroventrally and tips of the dorsal blades point dorsally or anterodorsally. With further growth the tissue enclosing the blades comes to project posteriorly from the haptor; tips of the ventral blades point anteroventrally and tips of the dorsal blades point anterodorsally. During differentiation, the tips of the blades of marginal hooks II come to point ventrally. The posterolateral margins of the larval disc fold dorsally and carry marginal hooks III and IV onto the dorsal surface of the haptoral lobes. Marginal hooks V come to lie laterally on the lobes while I, VI, and VII are ventral. Seven days postinfection, the haptoral sclerites of many worms are fully developed and some worms produce eggs. (Author). 000492

000020

Daye, P. G., Garside, E. T.

1979. Development and survival of embryos and alevins of the Atlantic salmon, *Salmo salar* L. continuously exposed to acidic levels of pH, from fertilization. Can. J. Zool. 57(9):1713-

1718. (Dep. Biol. Dalhousie Univ. Halifax, N.S. Canada B3H 4J1.).

Embryos and subsequent alevins of the Atlantic salmon, *Salmo salar* L. were incubated continuously from fertilization to a time 40 days after hatching at six levels of pH, 6.8 (control), 5.0, 4.5, 4.2, 4.0, and 3.7, at 5 to 6 C. Embryos had an  $LL_{50}$  of pH 3.9. The rate of embryonal development was not retarded by these levels. The  $LL_{50}$  for alevins was pH 4.3. Externally deformed alevins were few and not related in frequency to particular levels of pH. Populations of Atlantic salmon will decline and ultimately disappear from freshwater habitats whenever the level of pH approaches 4.5 for an extended period. (Authors). 000567.

000021

de Kinkelin, P.

1980. Occurrence of a microsporidian infection in zebra danio *Brachydanio rerio* (Hamilton-Buchanan). J. Fish Dis. 3(1):71-73. (Lab. Ichthyopathol. Inst. Natl. Rech. Agron. 78850-Thiverval-Grignon, France.).

Axial skeleton deformities, lordosis or scoliosis with associated melanosis, were found in young fish. Histological examination showed aggregates of an unidentified microsporidian parasite on the ventral side of the spinal cord but not elsewhere. (Ken Wolf). 000489

000022

Deshmukh, R. A.

1979. On a new cestode *Yorkeria southwelli* (Cestoda: Onchobothriidae) from a marine fish. Curr. Sci. (Bangalore) 48(6):271-272. (Dep. Zool. Marathwada Univ. Aurangabad 431 004, India.).

A new species of *Yorkeria*, *Y. southwelli*, is described from a new host from India. Twenty-five specimens of this species have been collected from the spiral valve of *Ginglymostoma conolor* at Ratnagiri (West Coast of India). (Author). 00629.

000023

Dojiri, M., Perkins, P. S.

1979. A new genus of cyclopoid copepod (Chondracanthidae) parasitic on halibut from California inshore waters. J. Parasitol. 65(5):794-803.

(Boston Univ. Mar. Program, Mar. Biol. Lab. Woods Hole, Mass. 02543.).

*Auchenochondria lobosa* gen. et sp. n. was recovered from the oral cavity of the California halibut, *Paralichthys californicus* (Ayers), collected in Agua Hedionda Lagoon, Carlsbad, California. (Authors). 000485.

000024

Fijan, N., Petrinc, Z., Sulimanovic, D., Zwillenberg, L. O.

1971. Isolation of the viral causative agent from the acute form of infectious dropsy of carp. Vet. Arh. 41(5-6):125-138. (Dep. Biol. Pathol. Fish Bees, Vet. Fac. Univ. Zagreb, Heinzelova 55, P. O. Box 190, 41001 Zagreb, Yugoslavia.).

A virus was isolated from 11 epizootics of the acute form of infectious dropsy of carp (IDC). The virus multiplies and causes a cytopathogenic effect in primary monolayer cultures of carp ovary cells and in FHM, BF-2, BB and RTG-2 cell lines. It is ether- and acid-sensitive. Its synthesis is not inhibited by iododeoxyuridine. The morphology in thin sections is undistinguishable from that of Egtved virus. However, the growth in FHM cells at up to 31 C and the low susceptibility of RTG-2 cells indicate that the virus differs from Egtved virus. The above properties place the virus into the rhabdovirus group. It was named, therefore, *Rhabdovirus carpio*.

Carp inoculated intraperitoneally or perorally with *R. carpio* and kept at about 11 to 19 C developed enteritis, peritonitis, petechiae, ecchymoses and edema in organs and tissues, usually with a fatal outcome. The virus apparently possesses a low degree of neurotropism. It caused death in most intracranially injected carp. Its etiologic role in the acute form of IDC has been established by the fulfillment of Rivers' postulates.

The relationship between the acute and the chronic form of IDC is unclear: a) the *R. carpio* was found neither in skin affected by the chronic form in epizootics nor in organs or skin of carp from serial laboratory passages of the chronic form and b) symptoms of the chronic form did not develop in carp inoculated with *R. carpio*. The disease caused primarily by *R. carpio* was named spring viremia of carp (SVC) in order to distinguish it from the rest of the broad complex covered by the present term infectious dropsy of carp. (Authors). 000638.



000025

Ghittino, P.

1977. Principal problems in the pathology of fishes in mariculture. (Principaux problèmes de pathologie pisciaire en mariculture.) Semin. Lab. Physiol. Etres Marins 3(6):219-229. (Lab. Ichthyopathol. Inst. Exp. Zoophylaxie, via Bologna 148, 10154 Torino, Italy.).

A brief review presented as a seminar. The subject matter is arranged according to infectious diseases (viral, bacterial, and mycotic), parasites, non-infectious diseases, nutritional diseases, and tumors. (Ken Wolf) (Paper in French). 000639.

000026

Giles, R. C., Brown, L. R., Minchew, C. D.

1978. Bacteriological aspects of fin erosion in mullet exposed to crude oil. J. Fish Biol. 13(1):113-117. (Dep. Microbiol. Mississippi State Univ. Miss. State, Miss. 39762.).

An investigation was undertaken to determine the effect of two types of crude oil on mullet (*Mugil cephalus*). The data presented in this report establishes a relationship between the exposure of the mullet to crude oils and the outbreak of fin rot. The data also indicates that the diversity of the microflora on the exterior of the mullet was reduced from 5-6 to 1-2 colonial types, one of which was consistently a species of the genus *Vibrio*. (Authors). 000503.

000027

Guma'a, S. A.

1978. The effects of temperature on the development and mortality of eggs of perch, *Perca fluviatilis*. Freshw. Biol. 8:221-227. (Freshw. Biol. Assoc. Windermere Lab. England.).

The rate of development and mortality of perch *Perca fluviatilis* was studied at ten different constant temperatures. The rate of development was inversely related to the incubation temperature, whereas the rate of mortality was directly related to the incubation temperature. The sum of heat ( $\Sigma H$ , degree-days) required for 10, 50 and 90 per cent of the eggs to hatch was found to be constant, regardless of the incubation temperature, with mean values (with 95 per cent confidence limits) of 91.4 (83.3-102.0) degree-days above 4.6 C for 10 per cent hatched, 97.0 (90.9-104.2) degree-days above 4.9 C for 50 per cent hatched and 101.0 (94.3-108.7)

degree-days above 5.0 C for 90 per cent hatched. Mortality among the different embryological stages was highest for the pre-hatching stage (i. e. when eye-pigment has been formed) at all temperatures. High mortality among the early stages occurred at temperatures below 8 C and above 12 C. (Author). 000569.

000028

Gupta, K. C., Roy, P.

1980. Alternate capping mechanisms for transcription of spring viremia of carp virus: evidence for independent mRNA initiation. J. Virol. 33(1):292-303. (Dep. Microbiol. Public Health, Univ. Alabama Birmingham, Ala. 35294.).

000560.

000029

Haller, R. D., Roberts, R. J.

1980. Dual neoplasia in a specimen of *Sarotherodon spilurus spilurus* (Gunther) (= *Tilapia spilurus*). J. Fish Dis. 3(1):63-66. (Baobab Farm, Bamburi, Mombasa, Kenya.).

A case report of two malignant tumors, lymphocytic lymphoma and tubular adenocarcinoma occurring simultaneously in a single adult male tilapia from a group of 45 specimens. Macro and micrographs are used to illustrate the short communication. (Ken Wolf). 000487.

000030

Hastein, T.

1973. Attempt to limit the outbreak of disease in fish hatcheries. (Tiltak for a begrensede sykdomsutbrudd i fiskeanlegg.) Saertrykk av Norsk Veterinaertidsskrift 85:73-77. (Veterinaer instituttet, Postboks 8156, Oslo-Dep. Oslo 1, Norway.).

Paper in Norwegian. 000615.

000031

Hauck, A. K., Fallon, M. J., Burger, C. V.

1979. New host and geographical records for the leech *Acanthobdella peledina* Grube 1851 (Hirudinea, Acanthobdellidae). J. Parasitol.

65(6):989. (Fish Pathol. Lab. Fish. Rehab. Enhancement Dev. Div. Alaska Dep. Fish Game, 333 Raspberry, Anchorage, Alaska 99502.).

This report constitutes the first record of *Acanthobdella peledina* on the North American continent as well as a new host for the coregonid *Coregonus sardinella*. (Authors). 000530.

000032

Hawke, J. P.

1979. A bacterium associated with disease of pond cultured channel catfish, *Ictalurus punctatus*. J. Fish. Res. Board Can. 36(12):1508-1512. (Dep. Fish. Allied Aquacult. Agric. Exp. Stn. Auburn Univ. Auburn, Ala. 36830.).

A new bacterial disease affecting primarily pond reared fingerling channel catfish, *Ictalurus punctatus*, is described from 17 instances reported from June 1976 through December 1978. Terramycin medicated feed controlled the disease when early diagnosis was possible. Terramycin resistant strains were not detected. The causative organism was confirmed as a previously unidentified species of *Edwardsiella* by the Center for Disease Control, Atlanta, Georgia. The disease is referred to as Enteric Septicemia of Catfish (ESC). Optimum growth temperature is between 25 and 30 C; this correlated with pond water temperatures during instances of mortality on fish farms. Koch's postulates were fulfilled using channel catfish fingerlings in 40 liter aquaria. (Author). 000506.

000033

Hazen, T. C.

1979. Ecology of *Aeromonas hydrophila* in a South Carolina cooling reservoir. Microb. Ecol. 5:179-195. (Biol. Dep. Wake Forest Univ. Winston-Salem, N. C. 27109.).

Densities of *Aeromonas hydrophila* were determined monthly from December 1975 to December 1977 in a South Carolina cooling reservoir which receives heated effluent from a single nuclear production reactor. Selected water quality parameters and prevalence of red-sore disease among largemouth bass were monitored simultaneously.

Higher densities of *A. hydrophila* were observed in areas of the reservoir receiving effluent from the reactor. Densities of *A. hydrophila* generally were heterogeneous in the water column. The sediments had lower densities of *A. hydrophila* than water immediately above. *Aeromonas hydrophila* could not be isolated from sediments greater than

1 cm from the water interface. Temperature, redox potential, pH, and conductivity were all significantly correlated with densities of *A. hydrophila* in the water column. The temporal and spatial distribution and abundance of *A. hydrophila* in water were not related to total organic carbon, dissolved organic carbon, particulate organic carbon, inorganic carbon, or dissolved oxygen. High densities of *A. hydrophila* were observed in mats of decomposing *Myriophyllum spicatum* and, enterically, in largemouth bass, several other species of fish, turtles, alligators, and snails. The greatest densities of *A. hydrophila* in water occurred during March and June with a second peak in October. The mean monthly densities of *A. hydrophila* were positively correlated with the incidence of infection in largemouth bass. Largemouth bass from thermally altered parts of the reservoir had a significantly higher incidence of infection. It is concluded that thermal effluent significantly affects the ecology of *A. hydrophila* and the epizootiology of red-sore disease within Par Pond. (Author). 000568.

000034

Henderson-Arzapalo, A., Stickney, R. R. Lewis, D. H.

1980. Immune hypersensitivity in intensively cultured *Tilapia* species. Trans. Am. Fish. Soc. 109(2):244-247. (Dep. Wildl. Fish. Sci. Texas A&M Univ. College Station, Tex. 77843.).

*Tilapia mossambica* maintained at high densities in an intensive-culture tank system displayed hypersensitivity to a component present in mucus and culture water. The component induced cutaneous anaphylactic reactions in *T. mossambica* and three other *Tilapia* species, but did not affect *Ictalurus punctatus*. Gel filtration studies revealed the component to be high molecular weight (larger than  $8 \times 10^5$  daltons) which electrophoretically migrated as a beta globulin. The component recovered from tank water of *T. mossambica* was not found in *T. aurea* tank water or in the incoming water. *Tilapia mossambica* experience higher mortality due to this autoimmune reaction, which limits the density at which this species can be stocked. Because the compound affects several species within the *Tilapia* genus, its effects should be considered when tilapias are stocked in fish culture operations. (Authors). 000528.

000035

Hendricks, J. D., Sinnhuber, R. O., Loveland, P. M., Pawlowski, N. E., Nixon, J. E.

1980. Hepatocarcinogenicity of glandless cottonseeds and cottonseed oil to rainbow trout (*Salmo gairdnerii*). Science 208(4441):309-311. (Dep. Food Sci. Technol. Oregon State Univ. Corvallis, Ore. 97331.).

Glandless cottonseed kernels are available for purchase and consumption by the general public. These kernels contain no gossypol but still have a full complement of naturally occurring cyclopropenoid fatty acids, which in rainbow trout are active as synergists with aflatoxins and primary liver carcinogens. Diets containing glandless cottonseed kernels or a lightly processed cottonseed oil produced significant numbers of hepatocellular carcinomas in rainbow trout after 1 year. The much greater incidence of cancer induced by the kernel than by the oil indicates that synergists or other carcinogens may be present in the kernel in addition to the cyclopropenoid fatty acids. (Authors). 000543.

000036

Hendrickson, G. L.

1979. *Ornithodiplostomum ptychocheilus*: migration to the brain of the fish intermediate host, *Pimephales promelas*. Exp. Parasitol. 48:245-258. (Dep. Zool. Sci. II, Iowa State Univ. Ames, Iowa 50011.).

Migration of cercariae of the diplostomatid trematode, *Ornithodiplostomum ptychocheilus*, to the brain of the fathead minnow, *Pimephales promelas*, takes place via directed, nonrandom movement. Penetration of the fish epidermis is rapid and is essentially complete by 2 hours postinfection. Migration to the central nervous system occurs almost exclusively via the general body musculature and connective tissue, although a few cercariae gain direct access to the nervous system via the eyes. Cercariae enter either the neural canal and spinal cord, or the brain via the spinal or cranial nerves and their associated foramina, although cercariae appear to remain in (on) these peripheral nerves for only a short time. Cercariae associated with cranial nerves continue to the brain. Those becoming associated with spinal nerves travel up the neural canal and (or) spinal cord to the brain. Data suggest that most arrive at the brain via the neural canal and spinal cord. Within the brain, most developing metacercariae (neascus-type) occur in the optic lobes and cerebellum. Whether this is 'selective localization' or merely the result of the larger space afforded by

these brain regions could not be determined. (Author). 000602.

000037

Heufelder, G. R., Schneeberger, P. J.

1980. Occurrence of the acanthocephalan *Leptorhynchoides thecatus* in slimy sculpins—a new host record. Trans. Am. Fish. Soc. 109(1):142-144. (Great Lakes Res. Div. Univ. Michigan, Inst. Sci. Tech. Ann Arbor, Mich. 48109.).

A new host (*Cottus cognatus*) for adults of the acanthocephalan *Leptorhynchoides thecatus* (Linton) is reported. Of 176 slimy sculpins examined from eastern Lake Michigan, 93 per cent were infected by *L. thecatus*. The number of *L. thecatus* infecting slimy sculpins was directly related to size of fish. Mean number of *L. thecatus* per fish was 17 for males, 10 for females, and 3 for immatures. One male was infected with 132 *L. thecatus*. (Authors). 000500.

000038

Jensen, N. J., Bloch, B., Larsen, J. L.

1979. The ulcus-syndrome in cod (*Gadus morhua*) III. A preliminary virological report. Nord. Veterinaarmed. 31:436-442. (Bulowsvej 13, DK-1870 Copenhagen V, Denmark.).

Previous pathological and bacteriological investigations of the ulcus-syndrome in cod indicated that also virological and environmental factors were involved in its initial papulo-vesicular stage. The present report describes the results of a virological investigation. Two viruses, a rhabdovirus and an icosahedral virus, presumably an iridovirus, were isolated from a group of cods with the ulcus-syndrome. (Authors). 000557.

000039

Jensen, N. J., Larsen, J. L.

1979. The ulcus-syndrome in cod (*Gadus morhua*). I. A pathological and histopathological study. Nord. Veterinaarmed. 31:222-228. (Bulowsvej 13, DK-1870 Copenhagen V, Denmark.).

Skin lesions in cod in Danish coastal waters are described, among these a specific ulcus syndrome can be differentiated. The ulcus syndrome develops from a papulo-vesicular stage to various forms of ulcerations. The most conspicuous histopathologi-



cal alteration in the papulous stage was observed in the loose connective tissue just beneath the epidermis. (Authors). 000592.

000040

Johnsen, B. O.

1978. The effect of an attack by the parasite *Gyrodactylus salaris* on the population of salmon parr in the river Lakselva, Misvaer in Northern Norway. *Astare* 11(1):7-9. (Dir. Wildl. Freshwater Fish, Elgesetertgt. 10, N-7000 Trondheim, Norway.).

A severe attack by the host specific parasitic flatworm *Gyrodactylus salaris* on juvenile salmon (*Salmo salar* L.), was observed in the river Lakselva in Misvaer county in Northern Norway. The first few *Gyrodactylus* infected salmon parr were found in August 1975. One year later, in August 1976, almost all salmon parr sampled at five stations were infected. Because of heavy mortality among the salmon parr caused by the *Gyrodactylus* attack almost all salmon parr had disappeared from the river by the time of August 1977. No trout infected by *Gyrodactylus* was found and the number of trout parr caught each year remained within expected annual variation. *Gyrodactylus* is a typical 'weakness-parasite' and heavy algal growth in the river, making the environment unfavorable in one way or another, is supposed to be the indirect cause of the *Gyrodactylus* attack on the salmon parr. (Author). 000541

000041

Katae, H., Kouno, K., Morkawa, S., Tashiro, F., Takahashi, S., Matsumaro, Y., Ushiyama, M., Miyazaki, T., Kubota, S. S.

1979. Studies on chemotherapy of fish diseases with piromidic acid. I. Absorption, distribution, excretion and toxicity of piromidic acid in some species of fishes. *Fish Pathol.* 14(2):79-91. (Dainippon Pharmaceutical Co. Ltd. Res. Lab. 25 Doshomachi 3-chome, Higashi-ku, Osaka 541 Japan.).

The pharmacokinetic and toxicological examinations of piromidic acid (PA, 8-ethyl-5, 8-d hydro-5-oxo-2-pyrrolidinopyrido(2,3-d)pyrimidine-6-carboxylic acid) were studied in ayu *Plecoglossus altivelis*, amago salmon *Oncorhynchus rhodurus* and eels *Anguilla japonica* and *A. anguilla* orally administered a single or multiple dose(s) of PA with the following results.

The absorption, distribution and excretion data obtained from the bioassay revealed that orally

administered PA was easily absorbed and quickly became distributed in blood and major organs. Peak levels were reached in 3 h (in ayu) or 6-24 h (in amago salmon) after the administration of PA, followed by a gradual decrease. The levels of PA in liver and kidney were higher than in blood and plasma.

In acute toxicity studies, the LD<sub>50</sub> value for ayu was more than 2000 mg per kg. The subacute toxicity of PA was studied in ayu (80 mg per kg), amago salmon (800 mg per kg) and eels (400 mg per kg) administered PA once daily for 5-10 days. Except for accidental death of two eels, all fishes receiving PA survived without any clinical and histopathological changes.

Disappearance of PA from the tissues in amago salmon was studied after the administration of 40 mg per kg of PA for 7 consecutive days. Peak levels of PA in the tissues tested were attained within 12 h following administration. A level below the assay limits (0.25-0.56 µg per ml or g) was reached 96 h post dosing. No evidence of long term residues.

000042

Kawamura, H., Awakura, T., Watanabe, K., Matsumoto, H.

1977. Therapeutic effects of erythromycin and the sensitivity of four salmonid fishes to bacterial kidney disease. *Sci. Rep. Hokkaido Fish Hatch.* 32:21-35. (Hokkaido Fish Hatch. Nakanoshima, Toyohiro-chi, Sapporo-gun, Hokkaido, Nippon, Japan.).

It was confirmed that bacterial kidney disease (BKD) occurred in a period from the winter, 1976 to early spring 1977 in juvenile chinook salmon, *Oncorhynchus tshawytscha* held at the Erimo and the Chitose Branches of the Hokkaido Fish Hatchery. Erythromycin was given to them at the rate of 100 milligrams per kilogram of fish per day during periods of 21 and 23 days in order to examine effects of the therapy. As a result the mortality at the Chitose Branch was almost repressed.

While three salmonid fishes, chum salmon (*Oncorhynchus keta*), masu salmon (*O. masou*), and steelhead trout (*Salmo gairdneri gairdneri*), were kept together with infected chinook salmon for 33 days, the incidence of kidney disease lesion was 42.9 per cent in chum salmon, 13.3 per cent in chinook salmon, 9.1 per cent in steelhead trout and 0 per cent in masu salmon at the end of the rearing.

Histopathological observations revealed that marked hypertrophies of ureter epithelium and

the connective tissue, and granulomous lesions occurred in the kidney were also found in pyloric caeca and gut. Hypertrophies of stratum compactum and muscularis. Spleen was occupied with a large number of blood cells at the most part but liver did not show any lesions to be seen. (Authors). 000537. (Paper in Japanese)

000043

Kirmse, P.

1979. Redescription of the life cycle of *Haemogregarina simondi* (Laveran and Mesnil, 1901) in its vertebrate host the marine fish *Solea solea* (Linnaeus). Z. Parasitenkd. 59:141-150. (Unit of Aquatic Pathobiol. Dep. Biol. Univ. Stirling, Stirling FK9 4LA, Scotland.).

The life cycle of *Haemogregarina simondi* is described in its vertebrate host the marine flatfish *Solea solea*. An intraleucocytic schizogony is followed by an intraerythrocytic schizogony giving rise to eight gametocytes. A differentiation into micro- and macro- gametocytes was also observed and thus confirms the results of other authors for *H. aeglefini*, *H. bigemina*, and *H. sachai*. It is postulated that most if not all of the haemogregarines of marine fish undergo similar life cycles as the one described here. (Author). 000580.

000044

Kirpichnikov, V. S., Faktorovich, K. A., Suleimanyan, V. S.

1972. Increasing the resistance of carp to dropsy by breeding. I. Methods of breeding for resistance. Soviet Genet. (Engl. Transl. Genetika) 8(3):34-41. (All-Union Sci.-Res. Inst. Pond Fish. Dmitrov. State Sci. Res. Inst. Lake River Fish. Leningrad, Russia.).

The injection of pathological material into the ventral cavity of healthy carp is a reliable method of infecting the fish with the acute form of dropsy and can be used in breeding work. Both a suspension of brain taken from diseased fish and a suspension prepared from a mixture of organs may be used successfully for injection. Rubbing pathological material into the skin also leads to the disease, but in this case it has a chronic nature.

The eosinophilic cytoplasmic inclusions usually observed in fish naturally infected with dropsy do not appear in the brain of carp infected by injection. The cause of the absence of inclusions is

probably the very rapid course of the disease after injection. (Authors). 000540.

000045

Kojima, H.

1978. Effects of tannic acid on aquatic fungi associated with diseases of fish eggs. Sci. Rep. Hokkaido Fish Hatch. 33:45-53. (Hokkaido Fish Hatch. Hokkaido, Japan.).

Malachite green is frequently used as a prophylactic for fish eggs. However, this pigment has become unbearable for environments, because colored drainage pollutes the water. Though some substitute for this pigment is desired, a suitable substance has not been found.

Some experiments, therefore, were attempted to estimate the effect of tannic acid as a prophylactic medicine on aquatic fungi, *Saprolegnia diclina* Humphey, isolated from diseased cherry salmon (*Oncorhynchus masou*) fry. Mycelium of *S. diclina* treated at 1 ppm tannic acid (pH 6.3) for 1 hour at 15 C grew as well as the nontreated condition (pH 6.6) on agar plate, however, tannic acid completely inhibited the mycelial growth at 1000 ppm (pH 4.1). This inhibitory effect seemed to be caused with unionized tannic acid but not with low pH, because mycelial growth was also inhibited with 1000 ppm tannic acid solution adjusted to pH 7.0 with 50 mM tris (hydroxymethyl) aminomethanesulfonic acid. On the other hand, the median tolerance limit (TLM) for tannic acid on the eyed eggs of steelhead trout (*Salmo gairdneri*) was approximately 170 grams per liter (170,000 ppm) and the water hardened eggs of chum salmon (*Oncorhynchus keta*) could sufficiently survive during repeated baths twice per week in 10 grams per liter (10,000 ppm) tannic acid solution for 1 hour. From these results, it was suggested that tannic acid as a prophylactic medicine for fish eggs has evident utility value. (Author). 000624. (Paper in Japanese)

000046

Kuhn, C., Vielkind, U., Anders, F.

1979. Cell cultures derived from embryos and melanoma of poeciliid fish. In Vitro 15(7):537-544. (Inst. Genet. Justus Liebig Univ. D-6300 Giessen, Fed. Rep. Germany.).

In poeciliid fish, melanoma of different degrees of malignancy can be produced by crossing specific genotypes. For a detailed investigation of the processes leading to proliferation or differentiation of the melanoma cells, it is necessary to establish cell



cultures. The aim of the present study was to find out the optimal conditions for initiating and culturing poeciliid fish cells for the purpose of establishing cell cultures of melanoma. The optimal method was developed by using small pieces of late embryos as starting material and includes: (a) dispersion of tissue by mild stepwise treatment with a trypsin-EDTA mixture at low temperature; (b) culture of cells in the complex medium 199; (c) supplementation of medium with high percentage (20 per cent) of fetal bovine serum; and (d) stabilization of pH by buffering the medium with HEPES. Under these conditions, primary and secondary cultures of embryonic cells have been initiated. An epithelial-like cell line has been subcultured for more than 80 passages. The method developed for embryonic tissues was used to start cell cultures from melanoma of platyfish-swordtail hybrids. Until now, only cells of rapidly growing malignant albino melanoma could be maintained in primary cultures. Secondary cultures could not be initiated since the melanoma cells tended to differentiate and stopped growing before a confluent monolayer was formed. (Authors). 000546.

000047

Laidler, L. A.

1980. Detection and identification of the bacterial kidney disease (BKD) organism by the indirect fluorescent antibody technique. *J. Fish Dis.* 3(1):67-69. (Minist. Agric. Fish. Food, Vet. Invest. Cent. Calthwaite, Penrith, Cumbria, England.).

The preparation of rabbit anti-BKD serum is described, and the specificity of the author's product shown. The indirect FAT was compared to gram staining and found to be superior for detection. The short communication confirms an earlier publication. (Ken Wolf). 000488.

000048

Larsen, J. L., Jensen, N. J.

1979. The ulcer-syndrome in cod (*Gadus morhua*). II. A bacteriological investigation. *Nord. Veterinarmed.* 31:289-296. (Bulowsvej 13, DK-1870, Copenhagen V. Denmark.).

The ulcer-syndrome in cod was shown not to be an etiological entity in a bacteriological sense as different bacterial species were found implicated. Primary skin alterations give access for bacterial invasion resulting in the development of ulcers and septicemia. (Authors). 000591

000049

Leibovitz, L.

1980. Ichthyophthiriasis. *J. Am. Vet. Med. Assoc.* 176(1):30-31. (Dep. Avian Aquat. Anim. Med. New York State Coll. Vet. Med. Cornell Univ. Ithaca, N. Y. 14853.).

An illustrated two page popular article on ichthyophthiriasis. Written for the veterinarian. (Ken Wolf). 000614.

000050

Lester, R. J. G., Budd, J.

1979. Some changes in the blood cells of diseased coho salmon. *Can. J. Zool.* 57(7):1458-1464. (Dep. Pathol. Ontario Vet. Coll. Univ. Guelph, Guelph, Ont. Canada N1G 2W1.).

Blood samples were taken from fingerling coho salmon (*Oncorhynchus kisutch*) that had been experimentally infected with either the bacterial pathogen causing vibriosis or that causing bacterial kidney disease. In the 2nd week after inoculation, smears from the *Vibrio*-infected fish contained enlarged thrombocytes, pinched erythrocytes, and neutrophils with vesicles. The total number of thrombocytes was reduced to 8000 per microliter, though this returned to 20,000 per microliter in the 3rd week in those fish that survived.

Blood smears from fish given the kidney disease bacterium contained enlarged thrombocytes and what appeared to be collapsed reticulocytes, in the 2nd and 3rd weeks. The thrombocyte count averaged 6500 per microliter, and there were reduced numbers of other cells. Bacteria were found in thrombocytes, neutrophils, and monocytes.

Light micrographs of 26 normal or modified cells and electron micrographs of two granulocytes are included. (Authors). 000495.

000051

Lidgerding, B. C., McAllister, P. E., Schultz, C. L.

1979. Fish cell lines: bisbenzamide staining for the detection of contamination. Page 186 in *Programs Abstr. 30th Annu. Meet. Tissue Cult. Assoc. Seattle, Wash. June 10-14, 1979. Abstr. No. 88.* (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Kearneysville, W. Va. 25430.).

Growth on mycoplasma agar, uptake of radioactivity labeled precursors, and nucleic acid staining were compared for the detection of mycoplasmas. Mycoplasmas were detected in cultures of fathead minnow (FHM) and rainbow trout gonad (RTG-2) cells by use of a mycoplasma medium. However, detection by culture required more than 3 weeks and specialized growth conditions and was inconsistent. More rapid and reliable tests were sought by using the comparative uptake of radioactively labeled uridine and uracil and nucleic acid staining with bisbenzamide, a fluoro-chrome stain. Uptake ratios were highly variable or below 200, an indication of positive contamination. However, fluoro-chrome staining of duplicate cultures was consistently negative. Subsequent studies revealed that FHM, RTG-2 and chinook salmon embryo (CHSE) cells had the ability to incorporate small amounts of uracil and that uracil uptake was unaffected by the uridine concentration. A low or variable uridine/uracil uptake ratio could be achieved by varying cell inoculum of incubation time. Fluoro-chrome staining is inexpensive, rapid, reliable and requires no specialized equipment. We found bisbenzamide staining to be effective for routine screening of fish cells for detection of mycoplasma contamination. (Authors). (Abstract only). 000599.

000052

Lidgerding, B. C., Schultz, C. L.

1979. Fish cell lines: establishment of the first suspension culture. Page 216 in Program Abstr. 30th Annu. Meet. Tissue Cult. Assoc. Seattle, Wash. June 10-14, 1979. Abstr. No. 222. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Kearneysville, W. Va. 25430.).

We sought to establish four fish cell lines in suspension culture. Cultures of brown bullhead (BB), bluegill fry (BF-2), fathead minnow (FHM) and rainbow trout gonad (RTG-2) cells were inoculated at  $5 \times 10^4$  cells per ml, into spinner flasks containing MEM suspension medium supplemented with 4 per cent fetal bovine serum and 0.15 per cent carboxymethyl cellulose. With all four lines, viable cells declined rapidly and continuously for the first 2 weeks, and the BB and BF-2 died. In contrast, 5 per cent of the initial inoculum number of FHM and RTG-2 cells survived. Viable cells were separated by centrifugation, additional cells added and the cultures continued. The supplementation was repeated at 2 to 3 week intervals and eventually resulted in an increase in the population of cells that survived in suspension. After 6 months, the FHM cells began rapid replication and could be subcultured, yet they also retained the ability to grow in static culture. Per unit volume FHM cells had densities 50 per cent greater

than normal static cultures. The success of suspension cultures was by maintaining a pH of 7.2 and by renewing medium at bi-weekly intervals. The RTG-2 cells have yet to undergo rapid replication but viable cultures have been maintained for over 3 months. (Authors). (Abstract only). 000600

000053

Lim, C., Lovell, R. T.

1978. Pathology of the vitamin C deficiency syndrome in channel catfish (*Ictalurus punctatus*). J. Nutr. 108(7):1137-1146. (Dep. Fish. Allied Aquacult. Auburn Univ. Auburn, Ala. 36830.).

Channel catfish fingerlings fed purified diets devoid of vitamin C showed reduced growth rate, deformed spinal columns, external and internal hemorrhages, erosion of fins, dark skin color and reduced bone collagen content after 8 to 12 weeks, whereas fish fed a diet containing 30 mg per kg of vitamin C had none of these anomalies after 22 weeks. A dietary level of 30 mg of vitamin C per kg was insufficient to prevent distortion of gill filament cartilage, although 60 mg of vitamin C per kg was sufficient. Vertebral collagen percentages of 25 or below and liver ascorbic acid levels of  $30 \mu\text{g}$  per gram or below appeared to be indicative of vitamin C deficiency in channel catfish fingerlings. Epidermis and dermis were almost completely healed and extensive collagen fiber formation had commenced in the somatic muscle, in experimentally inflicted wounds after 10 days in fish fed the vitamin C-free diet. Skin and muscle at the wound site were almost regenerated to normal after 10 days in fish fed 60 mg of vitamin C per kg of diet. (Authors). 000554.

000054

Lounatmaa, K., Janatuinen, J.

1978. Electron microscopy of an ulcerative dermal necrosis (UDN)-like salmon disease in Finland. J. Fish Dis. 1:369-375. (Dep. Electron Microsc. Univ. Helsinki, Finland.).

An ulcerative dermal necrosis-like salmon disease appeared in Laukaa Central Fish Culture Station in Middle-Finland in autumn 1976 showing lesions in different sites on diseased landlocked salmon *Salmo salar* L. sea trout *Salmo trutta trutta* L. and brown trout *Salmo trutta lacustris* L. Lesions from the diseased landlocked salmon were studied by transmission and scanning electron microscopy.

Both aquatic bacteria and fungi grew in abundance in the lesions, changing the fine structure of the epidermis.

In all of the lesions studied virus-like particles 30-33 nm in diameter were found. The relationship of these particles to the disease is still unresolved. (Authors). 000623.

000055

Macdonald, R. D., Kennedy, J. C.

1979. Infectious pancreatic necrosis virus persistently infects chinook salmon embryo cells independent of interferon. *Virology* 95(1):260-264. (Dep. Biol. Univ. Calgary, Calgary, Alta. T2N 1N4, Canada.).

Defective interfering virus particles mediate the persistent infection of chinook salmon embryo (CHSE-214) cells by infectious pancreatic necrosis virus (IPNV). The persistence did not involve the interferon system because (i) the initiation of persistently infected cells was not sensitive to actinomycin D, (ii) only homologous virus was inhibited, and (iii) no interferon-like activity was detected in the cultures. The homologous interference was group specific because it extended to IPNV and IPN-like viruses regardless of serotype. CHSE-214 cells were unable to respond to poly(rI)-poly(rC) and appeared to have a defect in the interferon system. (Authors). 000496.

000056

Mahajan, C. L., Agrawal, N. K.

1979. Vitamin C deficiency in *Channa punctatus* Bloch. *J. Fish Biol.* 15(5):613-622. (Fish Biol. Lab. Dep. Zool. Univ. Rajasthan, Janipur-302004, India.).

The results of a series of experiments on *Channa punctatus* previously conditioned to a complete synthetic diet and later fed vitamin C deficient diet for 210 days followed by 30 days of recovery with fortified vitamin C ration are reported. The survival, growth, morphological abnormalities and biochemical changes in tissue ascorbic acid and cholesterol levels were studied.

Deficiency of vitamin C resulted in a mortality of up to 25 per cent and retarded growth accompanied by anorexia and loss of weight. Marked skeletal abnormalities, viz. lordosis, scoliosis and degenerative changes in the thoracic vertebrae were revealed by X-ray studies. Biochemical investigations showed a significant decrease in blood and kidney ascorbic acid levels within a month of feed-

ing the deficient diet. A prolonged deficiency beyond 150 days resulted in a rapid rise in the cholesterol content of the liver. These biochemical changes were reversed when vitamin C was added to the ration. (Authors). 000504.

000057

Margolis, L., Arthur, J. R.

1979. Synopsis of the parasites of fishes of Canada. *Bull. Fish. Res. Board Can.* 199. 269 pp. (Dep. Fish. Oceans, Resour. Serv. Branch, Pacific Biol. Stn. Nanaimo, B.C. V9R 5K6, Canada.).

Published information on the parasites of Canadian fishes is assembled in two lists, Parasite-Host and Host-Parasite. Eight hundred and thirty named species of the following taxa have been reported: Protozoa (77 species), Myxosporidia (92), Turbellaria (1), Monogenea (163), Trematoda (179), Cestoidea (93), Nematoda (58), Acanthocephala (26), Hirudinoidea (21), Mollusca (3), Branchiura (10), Copepoda (104), and Isopoda (3). Additionally there are many records of parasites not identified to species level, including two species of Acarina. The Parasite-Host list is organized on a taxonomic basis and identifies for each parasite species its habitat (freshwater, marine, or brackish), site of occurrence (location) within the host, species of host(s), known geographic distribution in Canadian waters, and the published source of each host and locality record. The Host-Parasite list is organized according to taxonomy of the hosts and is accompanied by data on known distribution of the parasites. In addition to listing the cited references, a supplementary list of references is included to cover other Canadian literature on fish parasites. The work concludes with an index to parasites and hosts. Although taxonomic revision is not the aim of the synopsis, notes on taxonomy and nomenclature are included when appropriate and, of necessity, several new combinations and one new synonym are proposed. They are *Prosorhynchoides basargini* (Layman 1930) n. comb. for *Bucephalopsis b.* *Prosorhynchoides ozakii* (Nagaty 1937) n. comb. for *Bucephalopsis o.* *Prosorhynchoides pusilla* (Stafford 1904) n. comb. for *Bucephalopsis p.* *Thynnascaris brachyura* (Ward and Magath 1917 sensu Van Cleave and Mueller 1934) n. comb. for *Contracaecum brachyurum*; *Thynnascaris magna* (Smedley 1934) n. comb. for *Contracaecum mg.* *Thynnascaris melanogrammi* (Smedley 1934) n. comb. for *Contracaecum ml.* and *Echinorhynchus ekbaumi* Golvan, 1969 new synonym of *E. gadi* Zoega in O. F. Muller, 1776. (Authors). 000594.

000058

Matthews, G. M.

1979. Exposure of fingerling spring chinook salmon to mixtures of Furanace-10, quinaldine, and MS-222. *Prog. Fish-Cult.* 41(2):85-86. (Natl. Mar. Fish. Serv. Northwest Alaska Fish. Cent. NOAA, 2725 Montlake Blvd. East, Seattle, Wash. 98112.).

The study was carried out to determine if the addition of Furanace-10 (10 mg per liter) to anesthetic baths of quinaldine (5 mg per liter), MS-222 (30 mg per liter) or a mixture of quinaldine (5 mg per liter) and MS-222 (30 mg per liter) would cause mortality to fingerling chinook salmon. Fish were held for 1 h, allowed to recover, and observed for 3 days. Mortality was negligible. No evidence was given for benefits. (Ken Wolf). 000532.

000059

McAllister, P. E.

1979. Fish viruses and viral infections. Pages 401-470 in H. Fraenkel-Conrat and R. R. Wagner, eds. *Comprehensive virology*, Vol. 14. Plenum Publ. Corp. New York. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Kearneysville, W. Va. 25430.).

The advent of fish cell and tissue culture in the mid-1950s provided the technical impetus for expanding fish virology beyond the confines of disease transmission studies. A variety of fish viruses and viruslike agents have now been recognized, and most are associated with pathological conditions. Not unexpectedly, research interests have focused on those fish viruses which impact most significantly on economic and aesthetic sensitivities. As a result, some of the fish viruses have been well characterized and classified into established viral taxonomic groupings while others have been only partly characterized or demonstrated solely by electron microscopy and their classification is tentative.

This chapter presents a comprehensive, systematic account of the biochemical, biophysical, and biological properties of the fish viruses and viruslike agents as well as an overview of the diseases with which they are associated. (Author). 000595.

000060

McCraren, J. P., Millard, J. L.

1976. Current assessment of iodophors as egg disinfectants in warmwater fish culture.

*Proc. Natl. Fish Cult. Workshop*, Springfield, Mo. 1976. Mimeographed. 2 pp. (U.S. Fish Wildl. Serv. Fish Cult. Dev. Cent. San Marcos, Tex. 78666.).

000583.

000061

McVicar, A. H.

1979. The distribution of cestodes within the spiral intestine of *Raja naevus* Muller and Henle. *Int. J. Parasitol.* 9:165-176. (Zool. Dep. Univ. Aberdeen, Aberdeen, Scotland.).

The three tetraphyllidean cestodes *Acanthobothrium quadripartitum*, *Phyllobothrium piriei* and *Echeneibothrium* sp. occur in most parts of the spiral intestine of *Raja naevus* with peak infections in tiers 2 and 3, *Echinobothrium harfordi* (Diphyllidea) is restricted to anterior tiers, and *Grillotia erinaceus* (Trypanorhyncha) shows little attachment site specificity. Details of the distribution patterns can be correlated with the dorsoventral orientation of the gut in the body cavity, the internal anatomy of the spiral intestine and associated pathways of food movement, the surface topography of the mucosa, acidity, sugar gradients and intraspecific effects at high intensities of infection. The distribution of the larger ('mature') cestodes does not depend on the settling pattern of the larvae. (Author). 000564.

000062

Michel, C.

1979. Furunculosis of salmonids: vaccination attempts in rainbow trout (*Salmo gairdneri*) by formalin-killed germs. *Ann. Rech. Vet.* 10(1):33-40. (Lab. Ichtyopathol. I.N.R.A. Route de Thiverval 78850, Thiverval-Grignon, France.).

Two immunization trials were performed in rainbow trout, using a formalin killed *Aeromonas salmonicida* suspension. In the first experiment, 200 gram fish were administered orally or intraperitoneally. Circulating antibodies were elicited in injected animals only, but no protection was found when they were challenged with a highly virulent strain. Rough and smooth bacteria have provided similar agglutinin titers. In the second study, fingerlings were vaccinated by injection, but experimental disease was reproduced through IP or IM inoculations. Protection was effective in the second case. In the IP injected group the mortality was the same in vaccinated fish and controls, and carriers were detected among survivors 3 months later. The surprising fact is that serum agglutinins



did not always provide a protection. This last one depends on different factors such as pathogenicity of strains and route of penetration of the challenge bacteria. So, experimental challenge has to be improved. (Author). 000581.

000063

Michel, C.

1980. A standardized model of experimental furunculosis in rainbow trout (*Salmo gairdneri*). Can. J. Fish. Aquat. Sci. 37(4):746-750. (Inst. Natl. Rech. Agron. Lab. Ichthyopathol. Route de Thiverval, 78850 Thiverval-Grignon, France.).

With the aid of published information, we have developed a standardized and reproducible experimental model of furunculosis in rainbow trout (*Salmo gairdneri*). The infective doses ( $LD_{50}$  = 200 to 2000 germs, i.m.) employed strains of *Aeromonas salmonicida*, the virulence of which was maintained by passage in 15 gram fingerlings. The number of viable cells in the dose was conveniently determined using the drop-plate enumeration technique; however, meaningful cell counts could only be obtained if broth cultures used for infecting the fish were harvested early in the exponential growth phase ( $OD < 1.000$  at 525 nm). Better results were obtained with intramuscular injection than with intraperitoneal injection. The infection procedure involved injecting a dose of 10  $LD_{50}$ , intramuscularly, into each of 30 fish held at 15 C and recording the mortalities for 10 days. Protection tests in which Tribissen (28 mg sulfadiazine and 5.6 mg trimethoprim per kg fish for 8 days) was fed or tetracycline (1 mg per fish) i.m. injected into the infected fish served to demonstrate the value of the model. Results were in agreement with field observations with no death for treated fish and a mortality of 96 per cent for untreated fish. (Author). 000531.

000064

Miki, S., Awakura, T.

1977. The fine structure of *Glugea takedai* Awakura, 1974 (Microsporidia, Nosematidae). Sci. Rep. Hokkaido Fish Hatch. 32:1-19. (Fac. Fish. Hokkaido Univ. Oshoro-machi, Otaru, Hokkaido, Nippon, Japan.).

Life cycle of *Glugea takedai* occurring in the trunk muscle of an experimentally infected rainbow trout, *Salmo gairdneri irideus* and steelhead trout, *Salmo gairdneri gairdneri*, were observed by means of electron microscopy. Early to late schizonts and sporogony from sporoblasts to spores

were observed in the infected part of muscles. These parasites were found extracellular and surrounded by lysed muscle. The fine structure was basically similar to that of other Microsporidia particularly to that of *Nosema* species. In *Glugea* species, each sporont produces two spores. We observed some cytoplasmic connection existing between sporoblast and mature spores. These cytoplasmic connection were, however, supposed to be artifact or malformation because of their asymmetrical shapes. *Glugea takedai* was first reported as new species by Awakura (1974) through the light microscopical observations of cytoplasmic connection in sporoblast. The present study, however, clearly showed that the spores originated directly from sporont without any division. This indicates that the present species should be placed in the genus *Nosema*. (Authors). 000538. (Paper in Japanese)

000065

Mitchum, D. L., Sherman, L. R., Baxter, G. T.

1979. Bacterial kidney disease in feral populations of brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), and rainbow trout (*Salmo gairdneri*). J. Fish. Res. Board Can. 36(11):1370-1376. (Res. Lab. Wyoming Game Fish Dep. Univ. Stn. Laramie, Wyo. 82071.).

Incidence and effects of bacterial kidney disease (BKD) were determined in wild, naturally reproducing populations of brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), and rainbow trout (*Salmo gairdneri*) in a small lake and stream system in southeastern Wyoming, USA where BKD epizootics have been observed since 1972. During 1976, dead fish were collected at three upstream stations, and 60 live fish were collected from each of 11 stations. All fish were necropsied, and virological, bacteriological, and parasitological examinations were conducted by standard methods. An indirect fluorescent antibody technique was used to detect the BKD organism in cultures and kidney tissue smears. Bacterial kidney disease was diagnosed in 100 per cent of the dead brook trout collected. Incidence among live fish ranged from 83 per cent at an upstream station to only 3 per cent at the most downstream location, and was highest in brook trout and lowest in rainbow trout. Two longnose suckers (*Catostomus catostomus*), the only nonsalmonids collected, were found negative for BKD. Clinical signs of infection and the most severe infections were found only in brook trout. Five age-classes of feral brook trout were involved in the epizootics. Since other known pathogens were essentially absent, it is believed that all deaths were due to BKD. Relationships between species susceptibility to BKD, age-classes, water

chemistry and water temperatures, and certain ecological conditions are discussed. (Authors). 000616

000066

Munro, A. L. S., Duncan, I. B.

1977. Current problems in the study of the biology of infectious pancreatic necrosis virus and the management of the disease it causes in cultivated salmonid fish. Pages 325-337 in F. A. Skinner and J. M. Shewan, editors. Aquatic microbiology. Academic Press, New York. (Dep. Agric. Fish. Scotland, Mar. Lab. Victoria Road, Aberdeen, Scotland.).

000617.

000067

Munro, A. L. S., Liversidge, J., Elson, K. G. R.

1976. The distribution and prevalence of infectious pancreatic necrosis virus in wild fish in Loch Awe. Proc. R. Soc. Edinb. Sect. B (Nat. Environ.) 75(15):223-232. (Dep. Agric. Fish. Scotland, Mar. Lab. P. O. Box 101, Victoria Road, Aberdeen AB9 8DG, Scotland.).

A 3-year survey of wild fish in Loch Awe and the surrounding watershed has shown a restricted distribution and low prevalence of infection with infectious pancreatic necrosis virus. No signs of clinical disease were observed in infected fish. The restricted distribution close to a rainbow trout farm is consistent with the virus originating from this farm, where virus infected stocks have been found each year since 1971. The continuing low prevalence is also consistent with virus in wild fish resulting from the spread of infection from the farm. If infection is spreading between wild fish, it is slow within the time scale of the survey. The possible mechanisms of transmission of infection from the farm to wild fish are discussed. (Authors). 000597.

000068

Murphy, T.

1973. Ulcerative dermal necrosis (UDN) of salmonids—a review. Ir. Vet. J. 27(5):85-90. (Dep. Agric. Fish. Vet. Res. Lab. Abbotstown, Castleknock, Co. Dublin, Ireland.).

Ulcerative dermal necrosis is a disease of adult salmonids. The primary etiological agent has not been identified and the disease is still under investigation. Lesions are those of necrosis and ulceration of the epidermis of the unscaled regions of the skin. The disease generally manifests itself at low water temperatures, in migrating salmon entering rivers.

Lesions are frequently infected with a fungus *Saprolegnia parasitica*. Control of the fungus by repeated treatment of affected fish in hatcheries with a fungicide, malachite green, may lead to healing of ulcers and recovery from the disease.

Experimental evidence indicates that the etiological agent is infectious and water-transmitted. Evidence also suggests that inoculation of a filterable agent may be followed by the occurrence of UDN.

There is no method of preventing the occurrence of UDN in rivers. Affected salmon which spawn however produce viable ova. Since only part of the adult salmon population develops UDN and smolts and parr are not affected, the disease does not constitute a hazard to the existence of the salmon species. An apparently identical condition which occurred in some British rivers in the latter part of the last century eventually disappeared, without inducing permanent damage to the salmon population. (Author). 000590.

000069

Natarajan, R., Nair, G. B., Abraham, M.

1979. Incidence of *Vibrio parahaemolyticus* in relation to feeding habit of fishes. Curr. Sci. (Bangalore) 48(19):875-877. (Cent. Adv. Study Mar. Biol. Porto Novo 608 502, Tamil Nadu, India.).

Skin, gills, and posterior intestine of more than 1000 fishes taken from brackish waters near Porto Novo, South India, were cultured. *Vibrio parahaemolyticus* was found in about 37 per cent of the specimens. The occurrence of the bacterium was greatest among detritus feeders and lower among carnivores, planktivores, and omnivores. The organism was most abundant in gut contents and least on the skin. (Ken Wolf). 000601

000070

Nomura, T., Shimizu, I.

1979. Studies on the effect of bathing drugs to salmonid fishes. I. Bathing toxicity of nifurpirinol to chum salmon and kokanee fry. Sci.

Rep. Hokkaido Salmon Hatch. 33:17-23. (Hokkaido Salmon Hatch. Fish. Agency, 2-2, Nakano-shima, Toyohiraku, Sapporo, Japan.).

Bathing toxicity of Nifurpirinol (NFP) to chum salmon and kokanee fry was studied to use Furanace granule containing 0.1 gram NFP in 1 gram of Furanace granule.

In experiment-1, the fishes were exposed for 24 h at 6.0 ppm of NFP. The mortality of chum salmon increased with growth of the fry, being 0 per cent in 0.3D sic to 0.39 gram, 0-59.3 per cent in 0.51 to 1.23 gram, 70 per cent in 2.03 gram, 88 per cent in 2.32 gram and 100 per cent in 3.94 gram fish. The mortality of kokanee was 0 to 6.6 per cent in 0.92 gram fry.

In experiment-2, 50 per cent lethal concentration ( $LC_{50}$ ) at 48 hours was determined. The  $LC_{50}$  in chum salmon was changed from 4.78 ppm in 0.38 gram to 2.06 ppm in 3.23 gram fry, showing the increase of bathing toxicity with a growth of fry. The value in kokanee was 2.58 ppm in 0.92 gram fry.

In experiment-3, the fishes were exposed for 9 consecutive days in 0.5 and 1.0 ppm of NFP. At 0.5 ppm NFP in the chum salmon, no fish died during the experimental period in 0.38 and 1.49 gram fry, while 3.72 gram fry began to die from the 4th day on. At 1 ppm NFP, dead fish in 0.38, 1.49 and 3.72 gram chum salmon fry became recognizable from the 9th, 6th, and 2nd day of treatment on, respectively. The 0.92 gram kokanee fry began to die from the 4th day of bathing.

In experiment-4, the fishes were given 5 daily 1 hour exposures to 10 ppm of NFP. Dead fish were found only in 3.72 gram chum salmon fry from the second day on. No fish died during the experimental period in 0.38 to 1.50 gram fry of chum salmon and 0.92 gram fry of kokanee.

In experiment-5, acute toxicity was observed by bathing of fry for 1 hour at 10, 20, 40 and 80 ppm of NFP. The acute toxicity was recognized only in 3.72 gram chum salmon fry. In 0.38 to 1.49 gram chum salmon fry and 0.92 gram kokanee fry, no fish dies in any concentration.

From the results of these experiments, it was revealed that toxicity of NFP to fry of chum salmon and kokanee was low. (Authors). 000640. (Paper in Japanese)

000071

O'Leary, P. J., Rohovec, J. S., Fryer, J. L.

1979. A further characterization of *Yersinia ruckeri* (enteric redmouth bacterium). Fish

Pathol. 14(2):71-78. (Dep. Microbiol. Oregon State Univ. Corvallis, Ore. 97331.).

Seventeen cultues of enteric redmouth bacterium were examined biochemically at selected temperatures. Incubation temperature altered the motility of the bacterium. At 9 C nonfunctional peritrichous flagella were produced, while at 18, 22, and 27 C the bacterium was motile. The cells were nonmotile at 37 C due to a lack of flagellar production. The percent guanine plus cytosine was determined to be  $49.75 \pm 0.45$  ( $P = 0.05$ ). This work supports the proposal of *Yersinia ruckeri* as the genus and species designation of the enteric redmouth bacterium. (Authors). 000562.

000072

O'leary, P. J., Rohovec, J. S., Fryer, J. L.

1979. A further characterization of *Yersinia ruckeri* (enteric redmouth bacterium). Fish Pathol. 14(2):71-78. (Dep. Microbiol. Oregon State Univ. Corvallis, Ore. 97331.).

Seventeen cultures of enteric redmouth bacterium were examined biochemically at selected temperatures. Incubation temperature altered the motility of the bacterium. At 9 C nonfunctional peritrichous flagella were produced, while at 18, 22, and 27 C the bacterium was motile. The cells were nonmotile at 37 C due to a lack of flagellar production. The percent guanine plus cytosine was determined to be  $47.95 \pm 0.45$  ( $P = 0.05$ ). This work supports the proposal of *Yersinia ruckeri* as the genus and species designation of the enteric redmouth bacterium. (Authors). 000484.

000073

Pal, J., Pal, B. C., Bannerjee, R.

1978. Epithelial carcinoma in *Anabas testudineus*. J. Fish Biol. 13(6):693-694. (Dep. Zool. Univ. Kalyani, Kalyani 741235, West Bengal, India.).

Histological examination of a skin tumor from *Anabas testudineus* indicated its carcinogenic nature. Two types of bacteria were isolated from the tumor and adjacent tissue. (Authors). 000521.

000074

Parker, N. C.

1980. Stress physiology. Res. Inf. Bull. 80-5. 1 p. (U.S. Fish Wildl. Serv. Southeastern Fish Cult. Lab. Route 3, Box 86, Marion, Ala. 36756.).

000585.

000075

Paterson, W. D., Gallant, C., Desautels, D., Marshall, L.

1979. Detection of bacterial kidney disease in wild salmonids in the Margaree River system and adjacent waters using an indirect fluorescent antibody technique. J. Fish. Res. Board Can. 36(12):1464-1468. (Dep. Fish. Ocean, Fish. Environ. Sci. Div. Halifax Lab. Halifax, N. S. Canada B3J 2S7.).

The indirect fluorescent antibody technique demonstrated the enzootic nature of bacterial kidney disease in 224 of the 605 wild salmonids sampled from the Margaree River system and some adjacent waters. Asymptomatic infections were observed in 33.4 per cent of 456 Atlantic salmon (*Salmo salar*) parr and 35.1 per cent of 37 returning adults in samples taken from the source of the Margaree River to and including saltwater areas off the coast. (Authors). 000507.

000076

Reichenbach-Klinke, H.-H.

1974. The manifestation types of ulcerative dermal necrosis. (Die Erscheinungsformen der UDN (Ulcerative Dermalnekrose).) Muench. Beitr. Abwasser-Fisch.-Flussbiol. 25:47-54. (Zool. Parasitol. Inst. Univ. Munich, Kaulbachstrasse 37, 8 Munich 22, Fed. Rep. Germany.).

The so-called UDN (ulcerative dermal necrosis) is a skin disease with fungus infection in brown trout, brook trout, salmon, graylings, huchen, more rare in elder rainbow trout.

The symptoms of UDN can experimentally be caused by mucus dissolving stuffs (detergents), certain hormonal changes, probably by other poisons in the water.

Even when a virus cannot be denied most UDN-cases should be reduced on a synergistic effect of a skin damaging substance and trouble in the hor-

monal system. (Author). 000565. (Paper in German)

000078

Rudikov, N. I.

1975. Spring viremia in fish. (Vesenniaia virusnaia bolezni' ryb.) Veterinariya 6:64-66. (not available.).

000613. (Paper in Russian)

000079

Schachte, J. H. Jr.

1978. Immunization of channel catfish, *Ictalurus punctatus*, against two bacterial diseases. Mar. Fish. Rev. 40(3):18-19. (Fish Dis. Contr. Unit, Rome Fish. Lab. 8314 Fish Hatch. Road, Rome, N. Y. 13440.).

A field study was begun to compare the efficacy of three different routes of immunization of channel catfish, *Ictalurus punctatus*, intensively cultured in cages. A polyvalent bacterin against *Aeromonas hydrophila* and *Flexibacter columnaris* was administered by oral, injection, and immersion routes. Initial data indicated a humoral antibody response to all three routes. Thirty-day postimmunization agglutinin titers were as high as 1:1280 in fish injected with bacterin, 1:160 in immersion-treated fish, and 1:20 in orally immunized fish. Gut mucosal extracts of identical fish had precipitin titers as high as 1:5120 in immersed fish, 1:320 in orally immunized fish, and 1:160 in injected fish. Control titers were 1:80. No significant difference in protective immunity was detected. These data reflect initial results of a 2 1/2-year study which will be reported in full at a later date. (Author). 000622.

000080

Schachte, J. H. Jr.

1979. Iodophor disinfection of muskellunge eggs under intensive culture in hatcheries. Prog. Fish-Cult. 41(4):189-190. (New York State Dep. Environ. Conserv. Fish Dis. Contr. Unit, 8214 Fish Hatch. Road, Rome, N. Y. 13440.).

The iodophor Providone-Iodine (1 per cent active I<sub>2</sub>) was used at three concentrations, 100, 28, and 13 mg per L (1:100, 1:350, and 1:750) for 10 min, in an attempt to disinfect fertilized eggs of muskel-



lunge (*Esox masquinongy*) and to test the efficacy and toxicity of the compound on the eggs of cool-water species. No treatment effect was observed between treatments and controls or among treatments. However, no toxic effects of the iodophor were found at the concentrations of active I<sub>2</sub> considered efficacious for salmonids. (Author). 000508.

000081

Schlueter, R. A.

1976. Occurrence of the protozoan parasite, *Henneguya exilis* Kudo, on channel catfish in Indiana. Proc. Indiana Acad. Sci. 86:171. (Div. Sci. Math. Univ. Tampa, Tampa, Fla. 33606.).

Abstract only. 000589.

000082

Shieh, H. S.

1979. Effect of arginine analogues on a fish pathogen, *Aeromonas salmonicida*. Microbios 23:87-92. (Dis. Nutr. Sect. Fish. Environ. Sci. Fish. Environ. P. O. Box 550, Halifax, N.S. Canada B3J 2R3.).

The effects of arginine analogues on a fish pathogen, *Aeromonas salmonicida*, were investigated. This organism proved to be resistant in various degrees to most arginine analogues tested but was found to be sensitive to arginine hydroxamate. Inhibition of growth by arginine hydroxamate was reversed by the addition of arginine to the bacterial culture. Incorporation of <sup>14</sup>C from <sup>14</sup>C-amino acids, namely, guanidoarginine, glutamate, aspartate, alanine, isoleucine, serine, methyl-methionine, and cystine was affected. (Author). 000603.

000083

Smail, D. A., Egglestone, S. I.

1980. Virus infections of marine fish erythrocytes: prevalence of piscine erythrocytic necrosis in cod *Gadus morhua* L. and blenny *Blennius pholis* L. in coastal and offshore waters of the United Kingdom. J. Fish Dis. 3(1):41-46. (Sch. Environ. Sci. Plymouth Polytech. Plymouth, England.).

Giemsa stained blood smears prepared from blennies caught on the shores of southern England and from cod taken from the Celtic and North seas revealed fish with clinical piscine erythrocytic ne-

crosis (PEN). The findings recorded here extend the distribution data on PEN infections and report that the infection in the blenny and cod may possibly have a similar developmental pattern. Data are presented on the prevalence of the infection in the fish population samples and on the proportion of infected cells in the smears examined. (Authors). 000558

000084

Smail, D. A., Egglestone, S. I.

1980. Virus infections of marine fish erythrocytes: electron microscopical studies on the blenny virus. J. Fish Dis. 3(1):47-54. (Sch. Environ. Sci. Plymouth Polytech. Plymouth, England.).

This paper reports for the first time the application of the direct negative staining technique for the rapid confirmation of the viral nature of blenny piscine erythrocytic necrosis (PEN). The virus in negatively stained preparations has an internal core structure which appears in exact opposite contrast to that seen in thin sectioned virus. The resultant images from both negative staining and thin sectioning suggest that the organization of the core is unique amongst intracytoplasmic deoxyriboviruses (ICDVs). (Authors). 000556.

000085

Smith, J. D., Lankester, M. W.

1979. Development of swim bladder nematodes (*Cystidicola* spp.) in their intermediate hosts. Can. J. Zool. 57(9):1736-1744. (Dep. Biol. Lakehead Univ. Thunder Bay, Ont. Canada P7B 5E1.).

It has been confirmed experimentally that *Cystidicola farionis* develops to the infective third stage in amphipods. The third stage was reached more quickly in *Gammarus fasciatus* (5 weeks) than in *Hyalella azteca* (6 weeks) at 12-14 C and required 7 weeks to develop in *Pontoporeia affinis* at 5-7 C. Third-stage larvae were 437 µm long immediately after the second moult and grew up to 4.9 mm long. *Cystidicola cristivomeri* developed to the third stage in *Mysis relicta* but not in amphipods. Third-stage larvae were about 720 µm long after the second moult and grew up to 5.7 mm long. Third-stage larvae of *C. cristivomeri* up to 10.8 mm long were found in 0.8 per cent of *M. relicta* from a lake where lake trout were infected with the parasite. Third-stage larvae of *C. farionis* and *C. cristivomeri* grew considerably in the intermediate hosts and the gonads became well developed. Simi-

lar development has been reported in other cystidicolid but suggestions that larvae moult to the fourth stage in the intermediate host cannot be accepted. (Authors). 000493.

000086

Snieszko, S. F., Hoffman, G. L., McAllister, P. E.

1979. Fish diseases. Pages 269-274 in R. D. Teague and E. Decker, eds. Wildlife conservation principles and practices. Wildlife Society, Washington, D. C. 20014. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Route 3, Box 50, Kearneysville, W. Va. 25430.).

A brief listing of the principal parasites, bacterial, and viral diseases of fishes. Selected references are given for those who are interested in further reading. (Ken Wolf). 000547.

000087

Sokol, F., Koprowski, H.

1975. Structure-function relationships and mode of replication of animal rhabdoviruses. Proc. Natl. Acad. Sci. USA 72(3):933-936. (The Wistar Inst. Anat. Biol. 36th St. at Spruce, Philadelphia, Pa. 19104.).

000582.

000088

Somogyi, P., Dobos, P.

1980. Virus-specific RNA synthesis in cells infected by infectious pancreatic necrosis virus. J. Virol. 33(1):129-139. (Dep. Microbiol. Coll. Biol. Sci. Univ. Guelph, Guelph, Ont. N1G 2W1, Canada.).

000561.

000089

Svobodova, Z., Tesarcik, J.

1973. The red blood picture in erythrodermatitis, aerocystitis, and spring viremia of carp in the third vegetation period. Acta Vet. Brno 42(3):265-269. (Fish. Res. Inst. Czech. Acad. Agric. Vodnany, Czechoslovakia.).

A study was made on the red blood picture of carp in the third vegetation period. A total of 25 animals with incipient erythrodermatitis, 23 with summer erythrodermatitis, 63 carp recovering or recovered from erythrodermatitis, 28 carp with aerocystitis, and 4 carp with a simultaneous course of spring viremia and erythrodermatitis were examined. The results were compared with those obtained in healthy fish of the same age and kept under similar conditions. This comparison revealed that only the values obtained in the carp suffering from both spring viremia and erythrodermatitis may be of diagnostic value. The hematological data (i. e. the erythrocyte numbers, the hemoglobin content, the hematocrit value, the mean corpuscular volume, the mean corpuscular hemoglobin, the mean corpuscular hemoglobin concentration, the color index) in separate courses of erythrodermatitis and aerocystitis are within the range found in healthy carp of the same age kept under similar conditions. (Authors). 000598.

000090

Tashiro, F., Morikawa, S., Motonishi, A., Sanjo, I., Kimura, N. Inoue, K., Nomura, T., Ushiyama, M., Jo, Y., Hayashi, F., Kunimine, I.

1979. Studies on chemotherapy of fish diseases with piromidic acid. II. Its clinical studies against bacterial infections in cultured salmonids and eels. Fish Pathol. 14(2):93-101. (Gifu Pref. Fish. Exp. Stn. Gifu, Japan.).

The efficacy of piromidic acid (PA) against various bacterial diseases in cultured fish was evaluated clinically. PA was used for the treatment of furunculosis in Amago (*Oncorhynchus rhodurus*), Yamane (*Oncorhynchus masou*) and brook trout (*Salvelinus fontinalis*), vibriosis in rainbow trout (*Salmo gairdneri*), edwardsiellosis and red disease in eels (*Anguilla japonica*).

PA was mixed in feed and consecutively administered for 5-11 days at the rate of 10, 20 and 40 mg per kg. The fish in every disease responded to PA with reduction in mortality and were found to be cured of the disease during medication or within a few days post dosing. The efficacy of PA against furunculosis was more remarkable than those of sulfisoxazole and sulfamonomethoxine (100-200 mg per kg per day). When PA was administered to Amago with furunculosis at 10 mg per kg for 5 days, mean blood levels in diseased fish were found to be 0.81, 1.50 and 1.39 µg per ml 3 h post dosing on 1st, 3rd and 5th day of the medication, respectively. It was revealed that PA was well absorbed in the diseased fish without a marked difference in its absorption among them.

The administration of PA caused no abnormality in 120,000 fish of salmonids and 320,000 fish of eels including elvers. The results obtained from this study suggest that PA can be used for the control of bacterial diseases in salmonids and eels. (Authors). 000491.

000091

Taylor, S. G., Bailey, J. E.

1979. *Saprolegnia*: control of fungus on incubating eggs of pink salmon by treatment with seawater. Prog. Fish-Cult. 41(4):181-183. (Northwest Alaska Fish. Cent. Auke Bay Lab. Natl. Mar. Fish. Serv. P. O. Box 155, Auke Bay, Alaska 99821.).

Daily 2- to 3-h treatments with seawater safely and effectively controlled *Saprolegnia diclina* on eggs of pink salmon (*Oncorhynchus gorbuscha*) in two trials at Auke Creek Hatchery, southeastern Alaska. Survival in gravel incubators from the fertilized-egg stage to the fry stage was significantly higher ( $P < 0.005$ ) with seawater treatment (68 per cent) than with no treatment (41 per cent). In tray incubators, survival from the fertilized-egg stage to the eyed-egg stage averaged 95 per cent for the 1971 to 1976 broods after malachite green treatments and 96 per cent for the 1977 brood after seawater treatments. (Authors). 000509.

000092

Tesarcik, J., Veselsky, M.

1979. Rising incidence of ulcerous dermal necrosis (UDN) in Bohemian water courses. (Rostouci vyskyt pripadu ulcerozni dermalni nekrozy (UDN) v ceskych tocich.) Bul. VURH Vodnany 15(4):3-8. (Vyzkumny ustav rybarsky a hydrobiologicky Vodnany, pracoviste Cihlarska 51, 701 00 Ostrava, Czechoslovakia.).

The paper presents the survey of the incidence of UDN in Bohemian localities since 1974 as compiled by the authors. In 1974 the first finding of this virosis was recorded and demonstrated in laboratory in the West Bohemian region. The survey covers the time period from 1974 to the autumn of 1978 when UDN occurrence was reported from a number of other river basins.

The survey of findings concerning this infection is followed by a brief explanation of its etiology, pathogenesis, diagnostics and differential diagnostics, including therapeutic possibilities, and by an analysis and discussion of the findings, including the results of bacteriological and histological ex-

aminations. (Authors). 000501. (Paper in Czech.)

000093

van den Broek, W. L. F.

1978. The effects of *Lernaeocera branchialis* on the *Merlangius merlangus* population in the Medway Estuary. J. Fish Biol. 13(6):709-715. (Dep. Biol. Sci. City of London Polytech. Old Castle St. London, E1, England.).

Whiting entering estuarine waters during autumn are largely free from the copepod *Lernaeocera branchialis* (L.). Infection soon follows and, between 1973 and 1975, an average 40.4 per cent whiting were infected. The parasite's effects on fish weight over this period are assessed and, in a separate study, its effects on the host's lipid biochemistry determined. Mature adults of *L. branchialis* caused a significant reduction in body weight. Liver lipid content was also lower in these individuals, by more than 50 per cent. Phospholipid levels were lower but cholesterol readings were greater in infected fish. Fatty acid composition of liver lipids appeared unaffected. (Author). 000524.

000094

van Vuren, J. H. J., Hattingh, J.

1978. A seasonal study of the hematology of wild freshwater fish. J. Fish Biol. 13(3):305-313. (Div. Nature Conserv. P. O. Box 517, Bloemfontein, South Africa.).

Various hematological values of wild yellowfish (*Barbus holubi*), carp (*Cyprinus carpio*) and two species of mudfish (*Labeo umbratus* and *Labeo capensis*) were examined on a seasonal basis from May 1975-April 1976, obtained from three different localities. Hematological values of fish of different length groups (from all four species) were studied at one locality during winter only (June 1976-August 1976). Seasonal variations were observed in all of the parameters studied but no sexual differences were found and no significant changes in the hematology could be related to breeding season. Wide individual variations were evident in fish of different length groups and no correlation existed between fish length (and mass) and hematological values. (Authors). 000519.

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Vielkind, J., Haas-Andela, H., Anders, F.

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A genetic marker, the tumor gene *Tu*, which causes the formation of abnormal melanophores, the T-melanophores, in the skin of xiphophorine fish has been transferred by donor DNA from a *Tu* genotype to recipient embryos lacking *Tu*. Abnormal melanophores which are identical to the T-melanophores of the donor genotype occurred only in recipients treated with *Tu*-DNA and not in those treated with *Tu*-free control DNA. (Authors). 000551.

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Vielkind, J., Vielkind, U., Anders, F.

1971. Melanotic and amelanotic melanomas in xiphophorine fish. *Cancer Res.* 31:868-875. (Genet. Inst. Justus Liebig-Univ. Giessen, Leihgesternerweg 112-114, Giessen, Fed. Rep. Germany.).

Histological, electron microscopic, and biochemical studies on heritable melanotic and albino melanomas of platyfish-swordtail hybrids have been carried out. The very rapidly growing albino melanomas have been found to consist of less differentiated melanocytes than the more slowly growing melanotic melanomas. There seems to be a correlation between the degree of cytoplasmic differentiation of the melanoma cells and the rate of melanoma growth. Nucleic acid determination revealed that the albino melanomas possess a higher DNA content per unit fresh weight than the melanotic ones. Because of the lower degree of differentiation, the numerous autophagic vacuoles, and the higher DNA content, the albino melanomas seem to express a higher degree of malignancy than the melanotic ones. (Authors). 000548.

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Vielkind, U.

1976. Genetic control of cell differentiation in platyfish-swordtail melanomas. *J. Exper. Zool.* 196(2):197-204. (Genet. Inst. Justus Liebig-Univ. D-6300 Giessen, Fed. Rep. Germany.).

In certain fish hybrids, malignant transformation of pigment cells is due to the presence of a tumor gene (*Tu*), the action of which is controlled by several regulatory elements. Absence of these controlling genes causes rapid proliferation of the *Tu*-transformed cells and ultimately results in melanoma formation. One of these genes has been identified as a differentiation gene (*Diff*), since it seems to control the differentiation of the transformed pigment cells. Light and electron microscopy of *Tu*-transformed cells of fish differing in the dosage of *Diff* and the determination of tyrosinase activity in homogenates of the respective tissues revealed that the degree of cellular differentiation depends on the dosage of *Diff* present in the genome. It is concluded that the gene *Diff* promotes the differentiation of malignant melanoma cells into benign melanophores. (Author). 000553.

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Vielkind, U., Paul, E.

1978. Normal and malignant melanin-containing pigment cells of xiphophorine fish as studied with formaldehyde-induced fluorescence. *J. Invest. Dermatol.* 70(2):80-83. (Inst. Genet. Dep. Clin. Exper. Dermatol. Cent. Dermatol. Androl. Venereol. Justus Liebig Univ. Giessen, Fed. Rep. Germany.).

Embryonic skin and eyes, and melanomas of xiphophorine fish were investigated by formaldehyde-induced fluorescence in order to test whether the pigment cells in these tissues may be identified by a specific green-yellow fluorescence. Skin of pigmented fish embryos showed no fluorescence in the black pigment cells (melanocytes and melanophores), while skin of albino embryos showed a green-yellow fluorescence in all cells which correspond to the black pigment cells of pigmented embryos. The skin of both pigmented and albino embryos showed a bright orange fluorescence in the red pigment cells (pteridophores). No fluorescence was observed in the retinal pigment epithelium of pigmented embryos, while a green-yellow fluorescence was observed in the pigment epithelium of albino embryos. Neither the melanotic melanomas of pigmented fish nor the amelanotic melanomas of albino fish showed any specific fluorescence. (Authors). 000549.

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Vielkind, U., Schlage, W., Anders, F.

1977. Melanogenesis in genetically determined pigment cell tumors of platyfish and platyfish-swordtail hybrids: correlation between tyrosin-



ase activity and degree of malignancy. Z. Krebsforsch. 90:285-299. (Genet. Inst. Justus-Liebig-Univ. Giessen, Heinrich-Buff-Ring 58-62, D-6300 Lahn-Giessen, Fed. Rep. Germany.).

In the genetically determined pigment cell tumors of platyfish and platyfish-swordtail hybrids, the degree of malignancy of pigment cells which have been neoplastically transformed by a tumor gene (*Tu*) depends on the type and number of certain regulating genes (*R*). In the present study, the tyrosinase activities in tumors of different degrees of malignancy (black spots, premelanomas, melanomas) have been determined. The results demonstrate a close correlation between the level of tyrosinase activity and the degree of malignancy. Spot patterns consisting of completely differentiated (benign) *Tu*-transformed cells show no tyrosinase activity. Premelanomas containing a few incompletely differentiated (malignant) *Tu*-transformed cells in addition to many differentiated ones show moderate tyrosinase activities. Melanomas which contain increasing numbers of incompletely differentiated cells with increasing growth rates show high to extremely high tyrosinase activities. Thus, the tyrosinase levels present in these tumors can be used as an indicator for the degree of differentiation and, thereby, for the degree of malignancy of the neoplastically transformed pigment cells. (Authors). 000550.

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Vielkind, U., Vielkind, J.

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A report of nuclear polymorphism in melanoma cells of platyfish-swordtail hybrids. Nuclei show invaginations, pockets and blebs of unknown cause or function. The usual features are described and illustrated. (Ken Wolf). 000552.

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Surveys during 1970-1975 showed that the infection was widespread among flounders in the Baltic and that regional incidences ranged from 2 per cent to 8 per cent. Seasonal incidence ranged from

less than 1 per cent during summer-autumn to winter-spring peaks as high as 17 per cent. The disease affected fish mainly when they reached sexual maturity and was more common on the blind side. Males were the more susceptible as were fish of marginal and average condition. Tagging returns indicated a lower return among infected fish than from those without lymphocystis. (Ken Wolf). 000542.

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Wolf, K.

1979. Comparative pathogenesis and virulence of poikilotherm vertebrate herpesviruses. Pages 183-200 in P. A. Bachmann, ed. Proceedings of the 4th Munich Symposium on Microbiology on Mechanisms of viral pathogenesis and virulence, Munich, Germany. June 6-7. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Kearneysville, W. Va. 25430.).

At least 10 and possibly as many as 12 different herpesviruses are currently recognized among the three major classes of poikilotherm vertebrates. Six of the lower vertebrate herpesviruses have been isolated in culture. Four of the six agents evoke clear-cut clinical disease in susceptible hosts: gray patch disease of hatchling turtles, Lucke adenocarcinoma of frogs, channel catfish virus diseases, and salmonid herpesvirus disease.

The histopathological findings of the various diseases, including new information on effects of *Herpesvirus salmonis*, are described. The pathogenesis and virulence of lower vertebrate herpesviruses are discussed in terms of how they are influenced by factors such as temperature, host age at the time of initial exposure, target tissues or organs, and the immune response. Suitable test animals are a limiting factor in infectivity studies with amphibian and reptilian agents. The same is not so with the fish herpesviruses for they have been found among propagated species and suitable stocks of experimental animals are available. (Author). 000596

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1979. Histopathology of yearling sockeye salmon (*Oncorhynchus nerka*) infected with infectious hematopoietic necrosis (IHN). Fish Pathol. 14(2):59-64. (U. S. Fish Wildl. Serv. Natl. Fish. Res. Cent. Bldg. 204, Naval Support Activity, Seattle, Wash. 98114.).

Infectious hematopoietic necrosis (IHN) is generally believed to be a virus disease of very young salmonids. In recent years there have been increasing numbers of unpublished reports that this disease has been occurring uncharacteristically in fish as old as 7 to 14 months. In sockeye salmon (*Oncorhynchus nerka*) of this age the histological changes were not severe. Intestinal tract granular cells thought to be pathognomic in young fish were conspicuously absent. Kidney imprints showed necrobiotic bodies however, and subtle changes were observed in the spleen and kidney hematopoietic tissue. (Author). 000486.

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## TOXICOLOGY

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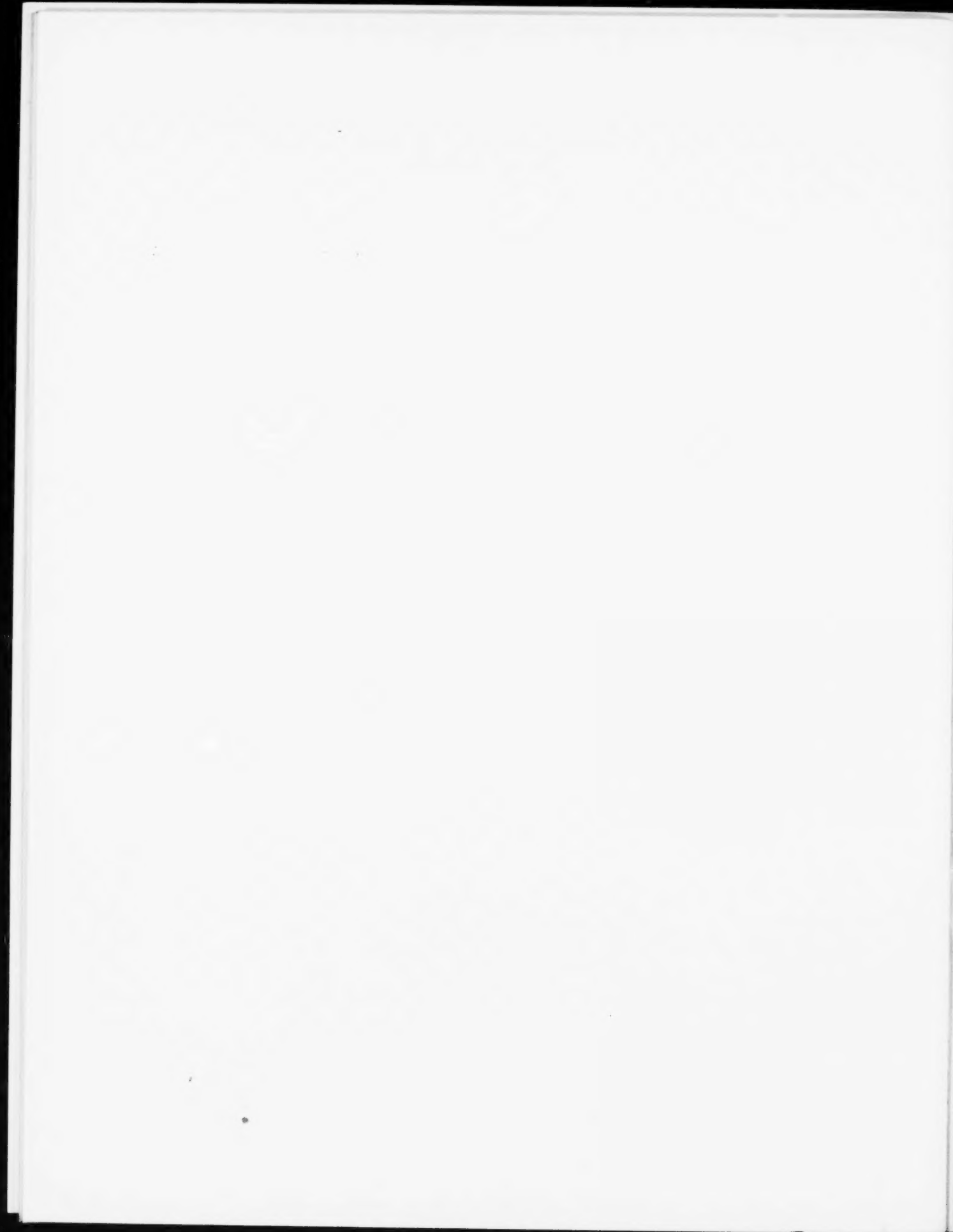
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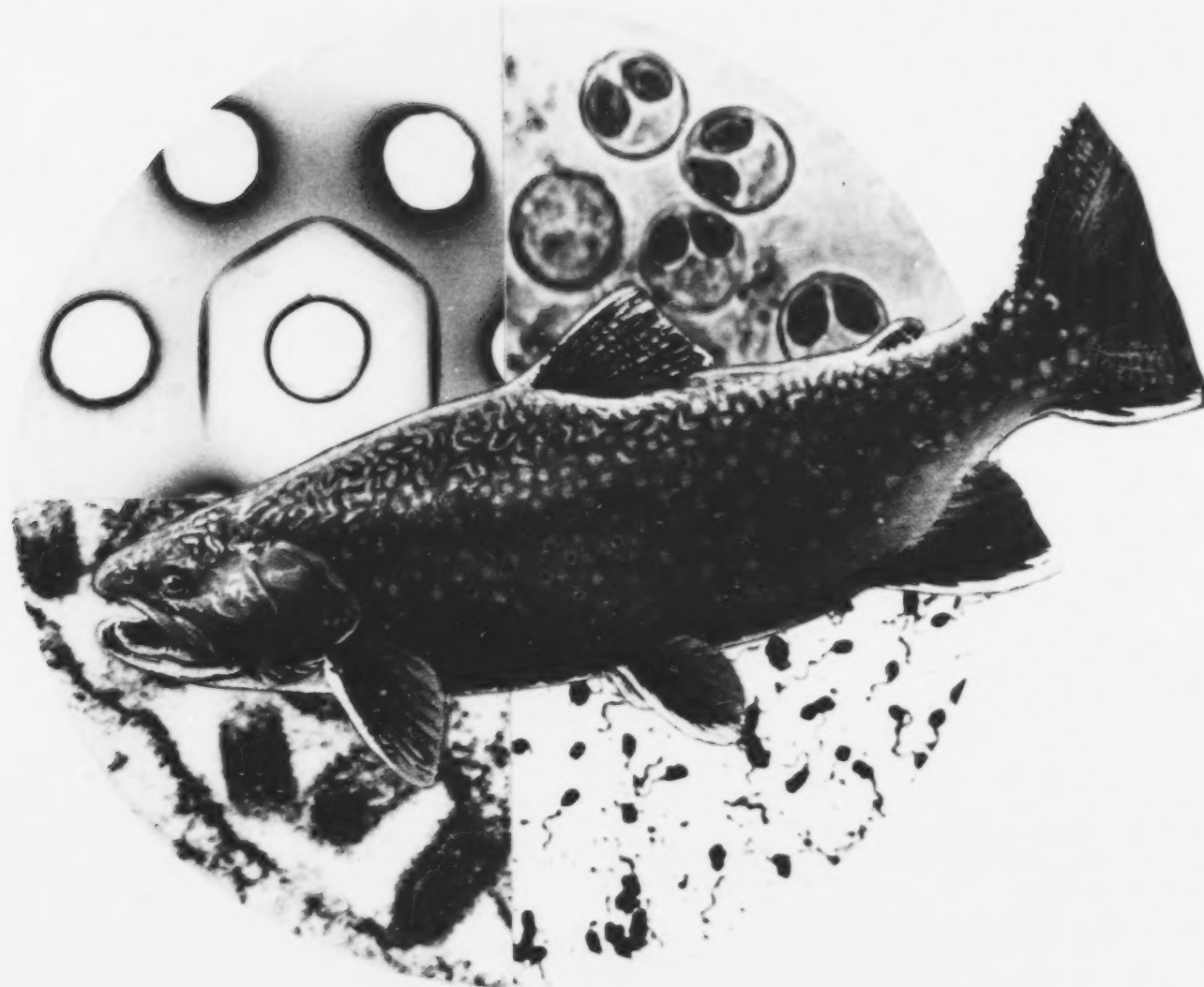
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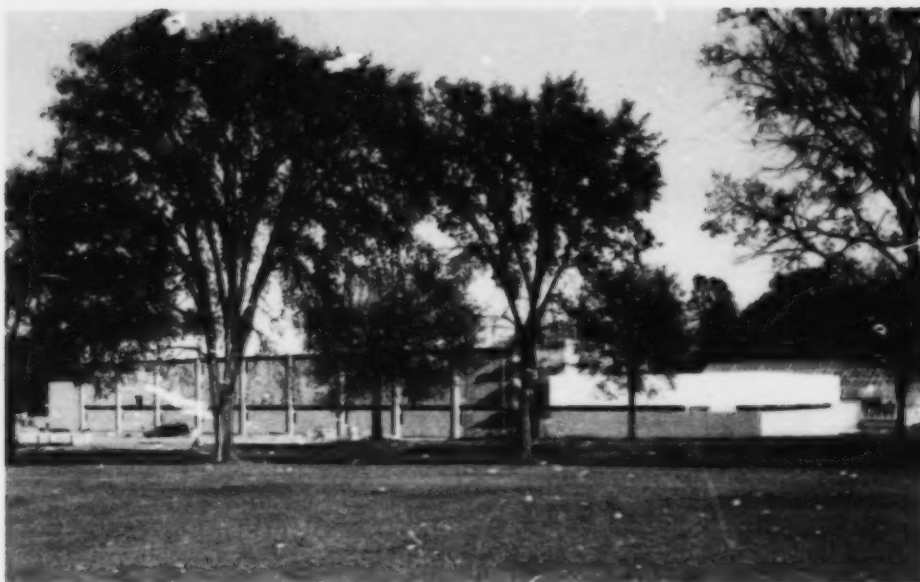
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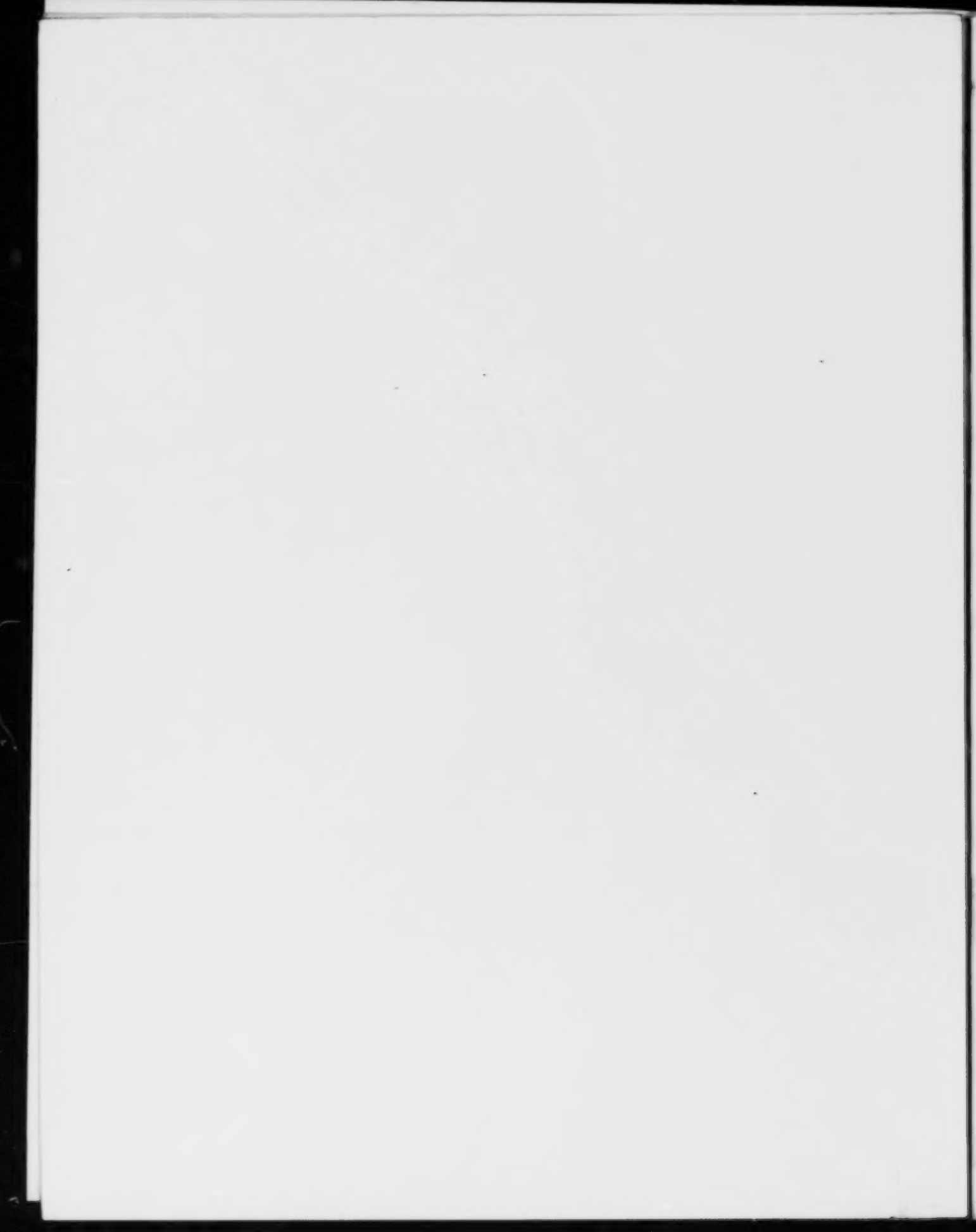
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Fish and Wildlife Service

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# THE HISTORY OF THE

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# Fish Viruses: Rhabdovirus Isolated from a Species of the Family Cichlidae

R. G. Malsberger and Gregory Lautenslager  
Department of Biology, Lehigh University  
Bethlehem, Pennsylvania 18015

During May 1980, a shipment of 50 Rio Grande perch (*Cichlasoma cyanoguttatum*) intended for behavioral studies rapidly developed signs of acute health problems and all specimens died within a week after their receipt. Necropsy included a virological examination, and an infectious agent was isolated in cell culture. We inoculated RTG-2, FHM, and BF-2 cells at an incubation temperature of 23°C. The latter two lines showed cytopathic effects (CPE) within 24 h. The RTG-2 line seemingly was refractory under similar conditions, but we later found that it too could show CPE if incubation were extended for 6 or 7 days.

Effects of temperature on virus replication were determined at 23 and 33°C. Tube cultures of BB, FHM, and RTG-2 cells were

inoculated with  $6 \times 10^3$  PFU of virus and assayed after 2 or 7 days incubation. The yield of FHM cells after 2 days at 23°C was  $3 \times 10^6$  PFU per ml, and at 33°C it was  $1 \times 10^7$  PFU per ml. The RTG-2 line yielded  $1 \times 10^6$  PFU per ml after 7 days, but the BB cell line yielded less than  $1 \times 10^2$  PFU per ml after 7 days.

As a means of determining the morphology of the agent, FHM cells were inoculated, incubated at 23°C for 22 h, fixed, then processed for electron microscopy. Infected cells showed typical rhabdovirus particles; most were found budding from cell membranes (Fig. 1), but a few free particles were also found. The free virions showed a bacillary rather than the usual flat based "bullet" shape.

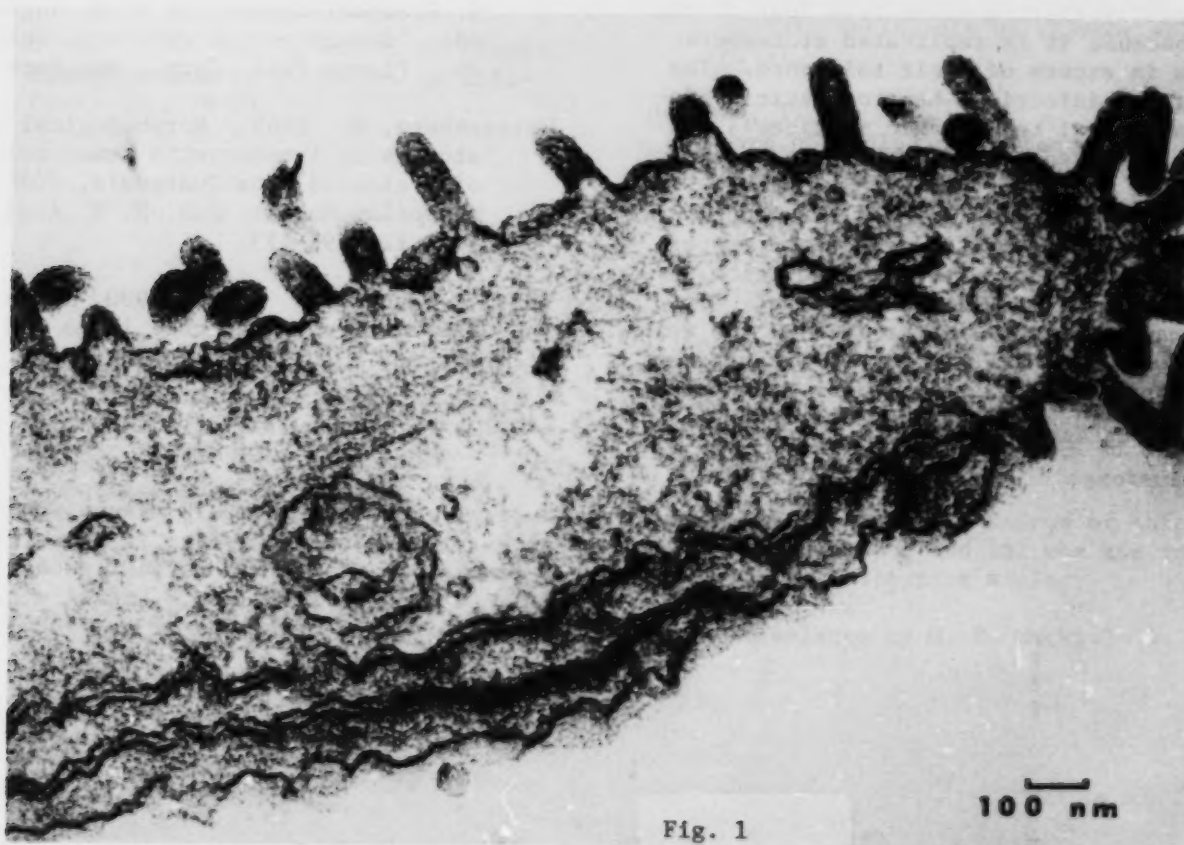


Fig. 1

As a test for pathogenicity, 0.1 ml of infectious cell culture medium containing  $4 \times 10^7$  PFU per ml of the agent was inoculated intraperitoneally into 10 convict cichlids (*C. nigrofasciatum*). Ten convict cichlids were inoculated with noninfectious cell culture medium and served as negative controls. Eight deaths occurred among the inoculated specimens during days 3 to 5, but two specimens survived 14 days. During the same 14-day-period, no deaths occurred among the control fish.

Infected cultures that were stained with acridine orange showed many cells with yellow-orange cytoplasmic inclusions. The inclusions were also visible by electron microscopy.

The cichlid agent is ether-sensitive, and its replication is not inhibited by actinomycin D nor by bromodeoxyuridine--features common to all rhabdoviruses.

According to a recent review, six rhabdoviruses are presently recognized in fishes (Wolf and Mann 1980). Our cichlid agent is readily distinguished from four of the six because it is replicated at temperatures in excess of their tolerance. The agents of infectious hematopoietic necrosis and viral hemorrhagic septicemia are not replicated at 23°C, a favorable temperature for the cichlid rhabdovirus. The agents of spring viremia of carp and of pike fry rhabdovirus disease have temperature maxima close to, but also below, that of our virus (de Kinkelin and Galimard 1973, McAllister 1979). The eel viruses EVA and EVEX might be excluded on the basis of geographic origin and host species, but serological comparisons will have to be made in order to draw firm conclusions.

Cichlids are known to harbor two other viruses. Weissenberg (1965) reported lymphocystis from a Guatemalan species, and Leibovitz and Riis (1980) described and illustrated an icosahedral virus about 120 nm in diameter that was associated with mortality among ram cichlids (*Aristogramma ramirezi*) imported from South America. The agent has not been isolated.

Further characterization of our cichlid rhabdovirus is in progress.

#### REFERENCES

- de Kinkelin, P., and B. Galimard. 1973. Isolation and identification of the causative agent of "red disease" of pike (*Esox lucius* L. 1766). *Nature* 241:465-467.
- Leibovitz, L., and R. C. Riis. 1980. A viral disease of aquarium fish. *J. Am. Vet. Med. Assoc.* 177:414-416.
- McAllister, P. E. 1979. Fish viruses and viral infections. Pages 401-470 in H. Fraenkel-Conrat and R. R. Wagner, eds. *Comprehensive virology*, Volume 14. Plenum Publ. Corp., New York.
- Weissenberg, R. 1965. Morphological studies on lymphocystis tumor cells of a cichlid from Guatemala, *Cichlasoma synapilum* Hubbs. *Ann. N. Y. Acad. Sci.* 126:396-413.
- Wolf, K., and J. A. Mann. 1980. Poikilothermic vertebrate cell lines and viruses. *In Vitro* 16(2):168-179.

## BOOK REVIEWS

Beall, D. D., editor. 1979. 1978 research in fisheries. Annual report of the College of Fisheries, Univ. Washington, Seattle, 98195. Contrib. No. 500. 101 pp.

The following studies are of interest:

Stober, Q. J., S. C. Crumley, and P. A. Dinnel.  
Effects of chlorination on aquatic organisms, a literature review.  
p. 15.

Bortz, B. M., and G. B. Pauley.  
The feasibility of immunization of rainbow trout (*Salmo gairdneri*) against eye fluke (*Diplostomum spathaceum*). p. 54.

Felton, S. P., M. L. Landolt, W. T. Iwaoka, B. S. Miller, D. H. DiJulio, B. Lloyd, and J. E. Hose.  
Benzo(a)pyrene toxicity study.  
p. 78.

Stromberg, P., R. Kocan, and M. L. Landolt.  
Sister chromatid exchanges in flatfish. pp. 78-79.

Mazurmovich, B. N., and Yu. I. Polyanskiĭ. 1980. Valentin Alexandrovich Dogel (1882-1955). "Nauka," Moscow, USSR. 176 pp. In Russian.

The book constitutes the biography, scientific, general, and academic activities of the famous Russian biologist, Laureate of Lenin's Award, V. A. Dogel. Dogel's contributions in the field of zoology of

Scordelis, P. A., D. Amend, and M. L. Landolt.  
Development of antimycotic drug.  
p. 79.

Quaife, C., K. Mottet, and M. L. Landolt.  
Arsenic as a piscine teratogen.  
p. 79.

MacMillan, J. R., D. Mulcahy, and M. L. Landolt.  
Viral erythrocytic necrosis. p. 79.

Abstracts of relevant doctoral dissertations are those of:

Casillas, E.  
Hematologic response of fish to independent changes in hydrostatic and gas pressure. p. 90.

Hardy, R. W.  
Effects of dietary protein and pyridoxine levels on growth and disease resistance of chinook salmon.  
p. 91.

Newcomb, T. W.  
Some physiological effects of total gas pressure supersaturated water on juvenile Pacific salmon and steelhead trout: a laboratory and field study.  
pp. 92-93.

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lower aquatic animals, protistology, parasitology and evolutionary morphology, and history of biology attained universal recognition.

This book is a valuable source of information for zoologists and all who are interested in the history of biology.

(Translated by M. E. Markiw)

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## ITEMS OF INTEREST

### INTERNATIONAL CONFERENCE ON IMMUNOLOGY AND IMMUNIZATION OF FISH June 23-24, Wageningen, The Netherlands

Following the 7th International Conference on Lymphatic Tissues and Germinal Centers in Immune Reactions (June 15-19, 1981) in Groningen, a 2-day conference on Immunology and Immunization of Fish will be held in the Zodiac building of the Agricultural University, Wageningen, on Tuesday and Wednesday, June 23 and 24, 1981. Wageningen is situated near Arnhem in the center of Holland.

The aim of the conference is to present recent developments in the study of fish immunology and fish vaccination and to promote the interaction between basic and applied laboratories active in this field. The conference language will be English.

The program will contain sessions with invited speakers and a poster-aided workshop. Free papers and posters will be selected from abstracts. Suggested topics are: phylogeny and ontogeny of immune systems, cellular immunity, humoral immunity, basic properties of immunoglobulin(s), cellular interactions, nonlymphoid cells and factors, immunological memory and tolerance, immunization and protection, stress, genetic factors, and disease resistance.

A second announcement containing a preliminary program, abstract instructions, and registration form will be sent upon request to: W. B. van Muiswinkel  
Agricultural University  
Zodiac, P. O. Box 338  
6700 AH, Wageningen, The Netherlands

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### 22nd ANNUAL WESTERN FISH DISEASE MEETING

The 22nd Annual Western Fish Disease Meeting will be held on June 23 and 24, 1981, at the Valley River Inn, Eugene, Oregon.

The schedule will consist of contributed papers or data and round table discussions concerning current disease problems.

For further information, contact David P. Ransom  
Oregon Aqua-Foods, Inc.  
88700 Marcola Road  
Springfield, Oregon 97477



## LIBRARY ACCESSIONS

000153

Ahne, W.

1979. Fish cell culture: a fibroblastic line (PG) from ovaries of juvenile pike (*Esox lucius*). In Vitro 15(11):839-840. (Inst. Zool. Hydrobiol. Univ. Munich, Fed. Rep. Germany.).

A new cell line derived by trypsinization of pooled ovaries is described. At 2.5 years of age the line is in 50th passage. Culture medium is MEM with 10% fetal bovine serum. Growth occurs at 4-25°C and the optimal is 20°C. Modal chromosome number is 48 and cells grow attached, not in suspension. Viral susceptibility includes IPNV, Egtved, PFR, and SVCV. (Ken Wolf). 000734

000154

Amend, D. F., Eshenour, R. W.

1980. Development and use of commercial fish vaccines. Salmonid 3(6):8-12. (Tavolek, Inc. 2779 152nd Ave. N.E. Redmond, Wash. 98052.).

000716.

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Anderson, D. P., Dixon, O. W., Roberson, B. S.

1979. Kinetics of the primary immune response in rainbow trout after flush exposure to *Yersinia ruckeri* O-antigen. Dev. Comp. Immunol. 3(4):739-744. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Route 3, Box 50, Kearneysville, W. Va. 25430.).

The purpose of these experiments was to follow the kinetics of the immune response of rainbow trout (*Salmo gairdneri*) held in spring water at the National Fish Health Research Laboratory - Leetown, West Virginia. Inasmuch as the immune response of fish is known to be temperature dependent and affected by pollution, the consistent environmental conditions provided by the Leetown spring water should allow a determination of optimal sampling times for analyzing the immune response in fish.

Recently we adapted the passive hemolytic plaque assay to detect antibody-producing cells in rainbow trout injected with a *Yersinia ruckeri* O-antigen preparation. This technique allows an earlier detection of the immune response than was possible by previous methods of assaying for circulating antibody. In experiments presented here, we followed the appearance of splenic antibody-producing cells in rainbow trout administered *Y. ruckeri* O-antigens by water contact through a flush exposure. In addition the kinetics of the appearance and continuation of circulating antibody was monitored by passive hemagglutination. (Authors). 000700.

000156

Antychowicz, J.

1979. Carp dropsy — erythrodermatitis. (Pocznica karpi — Erythrodermatitis.) Gospodarka rybna 31(9):18-19. (Not given.).

Carp erythrodermatitis occurs in Poland during the entire year. At the time he wrote the article, the author was unaware of the recent findings, namely that carp erythrodermatitis is very likely caused by an infection with a fastidious variant of *Aeromonas salmonicida*. In Poland, erythrodermatitis must be reported and the diseased fish populations must be disposed of according to strict sanitary regulations. (S. F. Snieszko). 000705. (Paper in Polish)

000157

Atkinson, H. M., Trust, T. J.

1980. Hemagglutination properties and adherence ability of *Aeromonas hydrophila*. Infect. Immun. 27(3):938-946. (Dep. Biochem. Microbiol. Univ. Victoria, Victoria, B. C. V8W 2Y2 Canada.).

Human diarrheal isolates and enterotoxigenic strains of *Aeromonas hydrophila* are strong hemagglutinators with human blood cells. Sugar inhibition studies and yeast coagglutination tests with 11 selected strains revealed six different hemagglutination mechanisms for this species. These were characterized by inhibition by L-fucose, inhibition by D-galactose, inhibition by D-mannose,

and two distinguishable mechanisms which were inhibited by either L-fucose or D-mannose, one being pilus mediated. Inhibition of hemagglutination by another strain required a combination of D-galactose and D-mannose. The hemagglutinating strains also attached well to human blood cells and buccal epithelial cells, with as many as 55% of the cells of a culture attaching successfully. In some cases the attachment to buccal epithelial cells appeared to involve mechanisms different from those used for hemagglutination. (Authors). 000717.

000158

Awakura, T., Tonosaki, H.

1978. Studies on *Henneguya* spp (Protozoa: Myxosporidia) parasitic in gobiid fishes. Sci. Rep. Hokkaido Fish Hatch. 33:101-115. (Lab. Fish Pathol. Hokkaido Fish Hatch. Sapporo, Hokkaido, Japan.).

The authors studied the host-parasite relationship between the myxosporidia and gobiid fishes from April 1977 to November 1978 in Lake Barato of Hokkaido. The results obtained from this study are summarized. (Authors). 000652. (Paper in Japanese)

000159

Belaud, A., Barthelemy, L.

1979. Influence of body temperature on nitrogen transport and decompression sickness in fish. Aviat. Space Environ. Med. 50(7):672-677. (Lab. Physiol. Fac. Med. 22 Rue Camille Desmoulins 29279, Brest, Cedex, France.).

Incidence of lethal bends and intravascular bubbles has been studied in the eel (*Anguilla anguilla* L.) submitted to hyperbaric air decompressions at temperatures of 17 and 27°C. The fish was an accurate model to seek the nature of the inert gas transport limiting process (diffusion or perfusion) because an increase in temperature considerably influences the rate of perfusion whereas the properties of gases vary in relatively lower proportions. Qualitative and quantitative analysis of the results are consistent with the hypothesis of a diffusion limited nitrogen transport through the tissues of the decompressed eel. (Authors). 000730.

000160

Blasiola, G. C. Jr.

1979. *Serpentisaccus magnificae* gen. et sp. n. a copepod (Caligoida: Lernaecercidae) from the firefish, *Nemateleotris magnifica* Fowler, 1938. J. Parasitol. 65(4):662-665. (Parasitol. Aquatic Biol. Steinhart Aquarium, California Acad. Sci. San Francisco, Calif. 94118.).

A new caligoid copepod is described from the firefish, *Nemateleotris magnifica* from the Philippines. The new genus, *Serpentisaccus*, is proposed, based on major differing morphological characteristics, which do not allow the copepod to be placed in any other existing genera within the Lernaecercidae. The characteristics include differentiation of the trunk into a clearly discernible anterior and posterior portion and ovisacs which are serpentine. (Author). 000746.

000161

Blasiola, G. C. Jr., Dempster, R. P., Morales, P.

1980. Uptake studies of ampicillin, nitrofurazone, and oxytetracycline in carp, *Cyprinus carpio*, with special reference to use of antibacterials in aquaria and notes on heparin as an anticoagulant. J. Aquaricult. 1(1):1-5. (Steinhart Aquarium, California Acad. Sci. San Francisco, Calif. 94118.).

Carp, *Cyprinus carpio*, were exposed to 24-h bath treatments with ampicillin, nitrofurazone, and oxytetracycline. Exposure concentrations were 14 and 28 µg per mL; 9, 12, and 20 µg per mL; and 13, 26, and 105 µg per mL respectively. Blood samples were taken at 6- and 24-h intervals and the plasma samples were assayed for antibacterial uptake. Therapeutic blood levels were not attained with any antibacterial used in this investigation. Heparin was used as an anticoagulant and did not interfere in the assays when used at a concentration of  $5.0 \pm 2$  units per mL of whole blood. (Authors). 000725.

000162

Blasiola, G. C. Jr., Turnier, J. C.

1979. Algal infection of the sevengill shark, *Notorynchus maculatus* Ayres. J. Fish Dis. 2(2):161-163. (Steinhart Aquarium, Golden Gate Park, San Francisco, Calif. 94118.).

About 1 month after capture, two of eight sevengill sharks in a community tank of other sharks

showed small white lesions in their skin. The number of foci and size of the lesions increased; all the sevengill sharks became affected and eventually died. At necropsy, the only pathologic change noted was that of the skin; numerous algae cells were found in necrotic foci in the epithelium. (Ken Wolf). 000690.

000163

Bullock, G. L., Griffin, B. R., Stuckey, H. M.

1980. Detection of *Corynebacterium salmoninus* by direct fluorescent antibody test. Can. J. Fish. Aquat. Sci. 37(4):719-721. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Route 3, Box 50, Kearneysville, W. V. 25430.).

A direct fluorescent antibody test (FAT) was developed for detecting *Corynebacterium salmoninus*, causative agent of bacterial kidney disease. The direct procedure was found to be as specific as the previously described indirect test, and requires only 7 min — about 1/20 as much time — to perform. A comparison of the direct FAT with the gram stain for sensitivity of detecting the bacterium indicated the fluorescent procedure to be 100 to 1000 times more sensitive. Furthermore, the FAT is highly effective and efficient for screening large numbers of samples. (Authors). 000697.

000164

Bullock, G. L., Snieszko, S. F.

1979. Enteric redmouth disease of salmonids. U.S. Fish Wildl. Serv. Fish Dis. Leaflet 57. 7 pp. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Route 3, Box 50, Kearneysville, W. Va. 25430.).

Enteric redmouth disease is a systemic disease principally affecting rainbow trout. Tentative diagnosis is based on findings of clinical signs, confirmation is based on isolation of a gram-negative motile rod. A combination of sulfamerazine followed by oxytetracycline or chloramphenicol has been used to treat outbreaks of ERM. (Authors). 000655.

000165

Bussmann, B., Ehrlich, S.

1979. Investigations on infestation of blue whiting (*Micromesistius poutassou*) with larval *Anisakis* sp. (Nematoda: Ascaridida). (Untersuchungen zum Befall des Blauen Wittlings (*Mi-*

*cromesistius poutassou*) mit Larven des Nematoden *Anisakis* sp. (Nematoda: Ascaridida). Arch. Fischereiwiss. 29(3):155-165. (Inst. Biochem. Technol. Aus der Bundesforschung. Fischerei, Hamburg, Fed. Rep. Germany.).

Blue whiting caught in January, May/June and November 1977 around the Faeroe Islands were examined for larval *Anisakis* sp. Higher worm burdens were found in May/June than in the winter months, and the level of infestation varied with geographical location. Worm burden did not appear to be related to host body length. Male fish appeared to be more heavily infested than females. In both sexes worm burden increased with increase in body length until it reached a maximum, then decreased. There was a positive association between the numbers of larvae in viscera, belly-flaps and fillet (ratio about 125:10:1). In general blue whiting appears to be not more infested than some other commercial fish species. (Authors). 000681.

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Caillet, C., Raibaut, A.

1979. Experimental observations about the sexuality of the branchial caligoid parasitic copepod *Clavellodes macrotrachelus* on its host *Diplodus sargus*. (Observations experimentales sur la sexualité du Copepode Caligoïde *Clavellodes macrotrachelus* (Brian, 1906), parasite branchial du Sar *Diplodus sargus* (Linne, 1758).) C. R. Acad. Sci. Paris 288D(2):223-226. (Lab. Ichthyol. Parasitol. Gen. Univ. Sci. Tech. Languedoc, Place E. -Eugene-Bataillon, F-34060 Montpellier Cedex, France.).

Some observations about the sexuality of the branchial parasitic copepod *Clavellodes macrotrachelus* have been carried out by infesting experimentally its natural host *Diplodus sargus* (Fishes, Teleostei). Free copepodids (infesting stage) although morphologically alike, are sexually determined. Females fasten themselves on any fish whereas males only fasten themselves when the host has been previously infested by an adult female of the same species. (Authors). 000645. (Paper in French)

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Canella, M. F.

1972. New knowledge about the holotrich ectoparasite of marine fish, discovered by Dr. Sikama and named *Cryptocaryon irritans* by Miss Brown. (Ce qu'on ne connaît pas sur un

holotriche ectoparasite des poissons marins, decouvert par le Dr. Sikama et appele *Cryptocaryon irritans* par Miss Brown.) Ann. Univ. Ferrara Sez III Biol. Anim. 3(9):107-132. (Lab. Zool. Univ. Ferrara, Italy.).

000650. (Paper in French)

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Chousterman, S., Lacasa, M., Sheldrick, P.

1979. Physical map of the channel catfish virus genome: location of sites for restriction endonucleases *EcoRI*, *HindIII*, *HpaI*, and *XbaI*. J. Virol. 31(1):73-85. (Inst. Rech. Sci. Cancer, 94800 Villejuif, France.).

000733.

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Chun, S.-K.

1976. The stress of drug treatment to common carp, *Cyprinus carpio*. Bull. Korean Fish. Soc. 9(4):265-271. (Natl. Fish. Univ. Pusan, Korea.).

Parasitic protozoans of fish, such as *Chilodonella*, *Costia*, *Trichodina*; *Ichthyophthirius* are effectively eradicated by treating with a mixture of 50-60 ppm formalin, 0.2 ppm malachite green and 0.6 ppm dipterex in water recycling aquariums. In this case any histopathological changes in the gills of fish were not observed. The parasites began to disappear 6 h after treatment.

Upon increased concentrations of formalin of 130 to 140 ppm, a significant change on the epithelium of gills was observed in 24-48 h after treatment. In this case gill epithelium degenerated and necrosis of the gill lamella supporting cells follows. (Author). 000736.

000170

Crosa, J. H.

1980. A plasmid associated with virulence in the marine fish pathogen *Vibrio anguillarum* specifies an iron-sequestering system. Nature (Lond.) 284(5756):566-568. (Dep. Microbiol. Immunol. SC-42, Sch. Med. Univ. Washington, Seattle, Wash. 98195.).

Many of the high-virulence strains of the marine fish pathogen *Vibrio anguillarum* isolated from epizootics of the widespread fish disease vibriosis,

harbor a specific plasmid class which is absent from low-virulence strains. Curing experiments have confirmed a link between this specific plasmic class and the ability of *V. anguillarum* to establish infections. In general, all bacterial virulence factors promote growth in the antagonistic environment of the host defense mechanisms. One line of defense is provided by the proteins transferrin and lactoferrin, which bind iron, rendering it unavailable to pathogens. A mechanism whereby invading bacteria may successfully compete for the otherwise unavailable iron could therefore become crucial in enabling them to proliferate in body fluids and tissues. I report here evidence which shows that the *V. anguillarum* virulence plasmid specifies a very efficient iron-sequestering system enabling bacteria to survive in conditions of limited iron availability. (Author). 000723.

000171

Crosa, J. H., Hodges, L. L., Schiewe, M. H.

1980. Curing of a plasmid is correlated with an attenuation of virulence in the marine fish pathogen *Vibrio anguillarum*. Infect. Immun. 27(3):897-902. (Dep. Microbiol. Immunol. Sch. Med. Univ. Washington, Seattle, Wash. 98195.).

The transposon A sequence Tn1 containing the ampicillin resistance determinants was transposed from RP4 to a plasmid of the marine fish pathogen *Vibrio anguillarum*. Curing experiments in which plasmid loss was determined by analysis of the segregation of the ampicillin resistance phenotype showed the association of virulence with the specific *V. anguillarum* plasmid class. (Authors). 000718

000172

de Kinkelin, P.

1980. Occurrence of a microsporidian infection in zebra danio *Brachydanio rerio* (Hamilton-Buchanan). J. Fish Dis. 3(1):71-73. (Lab. Ichthyopathol. Inst. Natl. Rech. Agron. 78850-Thiverval-Grignon, France.).

A case report involving axial skeleton abnormality, occasional mortality and concentrations of an unidentified microsporidian along the ventral side of the spinal cord. (Ken Wolf). 000708



000173

de Kinkelin, P., Chilmonczyk, S., Dorson, M., Le Berre, M., Baudouy, A. M.

1979. Some pathogenic facets of rhabdoviral infection of salmonid fish. Pages 357-375 in P. A. Bachmann, ed. Proceedings of the 4th Munich Symposia on Microbiology, Mechanisms of viral pathogenesis and virulence, Munich, Germany, 6-7 Jun. (Lab. Ichthyopathol. Stn. Virol. Immunol. Inst. Natl. Rech. Agronom. 78850 - Thiverval-Grignon, France.).

The salmonid rhabdoviruses produce systemic infections in fish causing serious lesions of hematopoietic tissues, blood capillaries and kidney tubules resulting in water retention in the fish body. The appellations of these diseases are viral hemorrhagic septicemia (VHS, 3 viruses) occurring in Europe and infectious hematopoietic necrosis (IHN, 1 virus) occurring in North America and Japan. Organ and cell infection substantiates the clinical findings but the entry of the virus and its subsequent events still remain unknown. Similarly the exact nature of the target cell(s) are to be determined. Standardized and efficient experimental infection procedures have been set up to produce the disease under conditions as close as possible to natural water route contamination. Thanks to them both host susceptibility and response could be investigated. The latter involves an interferon production followed by a humoral immunity associated with a strong resistance status. Sometimes there is only the resistance alone. Neutralizing antibodies are the most evident mechanism of immunity but they are strictly trout complement dependant with VHS virus, not with IHNV. This immune protection led to immunization assays using either live or inactivated virus. In spite of the fact that such a vaccination still demands thorough investigations it seems to be the most promising method for controlling rhabdoviral diseases of trout. (Authors). 000742.

000174

Duncan, B. L.

1977. Urceolariid ciliates, including three new species, from cultured Philippine fishes. Trans. Am. Microsc. Soc. 96(1):76-81. (Dep. Fish. Allied Aquacult. Agric. Exp. Stn. Auburn Univ. Auburn, Ala. 36830.).

As part of an effort to identify and control parasites of economic importance to fish culture in the Philippines, several previously undescribed ciliate parasites are herein reported.

Parasites were recovered from fish harvested from experimental ponds which receive water from an irrigation canal. The fish were crowded in concrete tanks for several days before examination. The three populations of *Trichodina heterodontata* n. sp. were recovered from different fish populations at different times.

The parasites were studied almost entirely from specimens prepared by Klein's silver impregnation technique. Acetocarmine was used as a nuclear stain. All measurements are in micrometers and follow the system proposed by Lom (1958), with the exception of denticle length, which in the present study does not include the inserted tip of the central part. (Author). 000683.

000175

Elliott, D. G., Shotts, E. B. Jr.

1980. Aetiology of an ulcerative disease in goldfish, *Carassius auratus* (L.): experimental induction of the disease. J. Fish Dis. 3(2):145-151. (Tavolek Inc. Redmond, Wash. 98052.).

Infection experiments were conducted to determine the primary aetiology of an ulcerative disease in goldfish, *Carassius auratus* (L.). Goldfish were exposed to atypical *Aeromonas salmonicida* and *Aeromonas hydrophila*, previously isolated from cutaneous ulcers, and to 0.45  $\mu$ m filtrates of cutaneous ulcers and kidneys from diseased fish. Fish were exposed to each preparation by intraperitoneal, intramuscular or subcutaneous injection and by a method in which a small patch of scales was removed from each side of the fish and the inoculum applied. Most of the fish injected with *A. salmonicida* died without developing cutaneous ulcers; however, ulcers were induced in five of the ten fish exposed by the scale removal technique. Exposure to ultrafiltrates or *A. hydrophila* did not result in consistent ulcer formation or death. Additional experiments showed that a 30-min exposure of goldfish, without prior treatment, to water containing  $3 \times 10^6$  colony forming units (cfu per ml) of *A. salmonicida* was sufficient to produce cutaneous lesions in nine of ten fish exposed. Multiple lesions were produced in most fish and *A. salmonicida* was consistently recovered. Fish exposed by similar waterborne challenges to  $6.2 \times 10^6$  cfu per ml of *A. hydrophila* or to  $7.2 \times 10^6$  cfu per ml of another lesion isolate identified as a member of the *A. hydrophila* complex produced no lesions, even when scales were removed. The studies demonstrate that atypical *A. salmonicida* can initiate cutaneous lesions characteristic of ulcerative disease, while *A. hydrophila* and an *A. hydrophila* complex organism cannot. (Authors). 000752.



000176

Elliott, D. G.,     Shotts, E. B. Jr.

1980. Aetiology of an ulcerative disease in goldfish *Carassius auratus* (L.): microbiological examination of diseased fish from seven locations. *J. Fish Dis.* 3(2):133-143. (Tavolek Inc. Redmond, Wash. 98052.).

A comparative diagnostic study was conducted on goldfish, *Carassius auratus* (L.), with a cutaneous ulcerative disease from five locations in the United States and one each in England and Japan. Fish were examined for parasites, viruses and bacteria. Fish from all locations examined were infested by ectoparasites; no single parasite species was common to all locations. No virus-associated cytopathology was observed in fathead minnow (FHM) or adult goldfish (CAR) monolayer cell cultures inoculated with homogenates of cutaneous lesions, kidneys and livers from diseased fish. The only bacterium cultured from fish from all locations was an atypical, often late-pigmenting strain of *Aeromonas salmonicida*. This organism was isolated from 64 of 83 (77%) of the total lesions cultured and was most prevalent in early lesions. A second commonly isolated organism was *Aeromonas hydrophila*, which was cultured from fish at four of the seven locations and from 28 (34%) of the total lesions cultured. *Aeromonas hydrophila* was most prevalent in terminal lesions. From these studies it was concluded that *A. salmonicida* was the probable cause of ulcers noted in the cases examined and that *A. hydrophila* was a secondary invader. (Authors). 000751.

000177

Eurell, T. E.,     Lewis, D. H.,     Grumbles, L. C.

1979. Stained bacterial antigens for use in microagglutination procedures. *Prog. Fish-Cult.* 41(2):55-57. (Dep. Vet. Microbiol. Texas A&M Univ. College Station, Tex. 77843.).

We describe the preparation of tetrazolium-stained antigens from three significant bacterial fish pathogens — *Aeromonas hydrophila*, *A. salmonicida*, and enteric redmouth bacterium — for use in a microagglutination system. Serum titers revealed by the microagglutination test and the conventional tube agglutination test were practically identical. The principal advantages of the microagglutination procedure relate to conservation of time, space, and serologic reagents. (Authors). 000692.

000178

Ferguson, H. W.,     Rice, D. A.

1980. Post-spawning mortalities in brown trout *Salmo trutta* L. *J. Fish Dis.* 3(2):153-160. (Vet. Res. Lab. Stormont, Belfast, Northern Ireland.).

An oedema syndrome caused mortality of 55.5% in brood brown trout approximately 2 months after spawning. The pathology and clinical biochemistry of the condition are described. It is suggested that the severe hypoproteinaemia and anaemia were due mainly to the traditional reduction in feed levels prior to spawning at a time when the water temperatures were abnormally high. It is also suggested, however, that the syndrome would not have occurred if the fish had not developed an aeromonad infection prior to stripping. Concurrent fungal infection and subsequent extremely low water temperatures are also thought to have played a role. (Authors). 000750

000179

Fischthal, J. H.

1979. *Asymphylogora fishelsoni* sp. n. (Trematoda: Monorchidae) from a cyprinodontid fish, *Aphanius dispar richardsoni* (Boulenger), from Israel, and its allometric growth. *J. Helminthol.* 53:357-362. (Dep. Biol. Sci. State Univ. New York at Binghamton, Binghamton, N. Y. 13901.).

*Asymphylogora fishelsoni* sp. n. is described from the cyprinodontid fish, *Aphanius dispar richardsoni*, an endemic subspecies from a brackish water spring flowing into the Dead Sea at Ein Fashkha, Israel. The new species is closest to *A. carpioe* Szidat, 1943, but differs significantly in being less than half its size, and in having the vesicular pars prostatica in the form of a distinct chamber, the caeca always inflated (rather than narrow), the seminal vesicle entirely postacetabular (rather than overlapping the acetabulum) and occupying 40 to 48 per cent of the cirrus sac length (rather than 80 per cent), the cirrus overlapping the acetabulum (rather than being entirely sinistral to it) and occupying 44 to 50 per cent of the cirrus sac length (rather than 18 per cent), and the anterior part of the terminal organ representing 35 to 54 per cent of the total length of this organ (rather than 22 per cent). Positive allometric growth is shown by the hindbody, posttesticular body, and gonads, whereas the forebody, suckers, and pharynx are negative. (Author). 000676.

000180

Fujii, T., Nakagawa, H., Murakawa, S.

1979. Immunity in lamprey. II. Antigen-binding responses to sheep erythrocytes and hapten in the ammocoete. *Dev. Comp. Immunol.* 3(4):609-620. (Dep. Biol. Fac. Sci. Niigata Univ. Niigata 950-21, Japan.).

The present studies were designed to determine whether cellular immune responses of ammocoete (larval lamprey), *Lampetra reissneri*, to heterogeneous erythrocytes is comparable in complexity to and shares similar recognition mechanisms with those of other gnathostomes. These responses were measured by means of immunocytoadherence. The levels and kinetics of antigen-binding activity in the peripheral blood and primitive spleen (typhlosole) were established by following a single high (10%) or low (0.001%) SRBC challenge. Antigen-binding responses were similar in some respects to those previously reported for other poikilothermic vertebrates. Rabbit anti-arctic lamprey Ig inhibited antigen-binding of immunocytes. Hapten-carrier immunization was used to explore lymphoid heterogeneity in this species. The anti-hapten (2,4,6-trinitrophenyl;TNP) response was not specifically enhanced by carrier priming, however, there were many lymphoid cells bearing anti-TNP receptors in untreated ammocoetes. Consequently, it is doubtful whether there is cell-cell collaboration in the lamprey immune system. (Authors). 000698.

000181

Funahashi, N.

1980. Histopathological studies on gill — I. A bacterial gill disease of cultured eel. *Fish Pathol.* 14(3):107-115. (Fac. Fish. Mie Univ. Edobashi, Tsu, Mie, Japan.).

A bacterial gill disease named 'Eragusare-byo' occurred among pond-cultured eels in Fukui Prefecture during March 1974. The pond-cultured eels with the disease included two species, Japanese eels (*Anguilla japonica*) and European eels (*A. anguilla*). The water temperature of the ponds was above 20°C throughout the year. Histopathological changes were observed on the gill lamellae as inflammatory edema, swelling of the epithelial cells, and excessive secretion of mucin. Column-like protrusions formed by a number of slender, rod-shaped gram-negative bacteria were often found on the surfaces of the gill lamellae in these eels. (Author). 000696. (Paper in Japanese)

000182

Giavenni, R.

1979. Human skin lesions by fish mycobacteria. (Alcuni aspetti zoonosici delle micobatteriosi di origine ittica.) *Riv. Ital. Piscic. Ittiop.* 14(4):123-126. (Med. Vet. S.I.R.A.P. S.p.A. 30100 Pellestrina, Venezia, Italy.).

Human lesions by fish mycobacteria have been becoming more and more frequent during the last years, in obvious connection with the increasing diffusion of the aquarium hobby, which therefore seems to represent one of the most dangerous sources of infection. Skin lesions observed in man are described in this paper and some references to fish infection are also given. Emphasis is put on the need of prophylactic measures to be taken in tropical fish trade in order to avoid a further diffusion of this zoonosis. (Author). 000702. (Paper in Italian)

000183

Goven, B. A., Dawe, D. L., Gratzek, J. B.

1980. In vivo and in vitro anaphylactic type reactions in fish. *Dev. Comp. Immunol.* 4(1):55-64. (Dep. Med. Microbiol. Coll. Vet. Med. Univ. Georgia, Athens, Ga. 30602.).

Anaphylactic type reactions occurred in channel catfish (*Ictalurus punctatus* Rafinesque) and goldfish (*Carassius auratus* L.) following immunization and challenge with several protein antigens. The reactions were specific for the sensitizing antigen and could be passively transferred to nonsensitized recipients with serum from sensitized fish. In channel catfish the reaction consisted of disorientation, vertical swimming, increased opercular movement and gasping. In the goldfish the reaction consisted of clamping of the fins except the pectorals, loss of equilibrium, and increased defecation. Some deaths occurred with the catfish.

The effects of various concentrations of histamine on the rhythmicity and tonus of goldfish and catfish intestinal smooth muscle were also measured in vitro. Isolated intestinal sections were maintained in a Schultz-Dale chamber which was connected to a physiograph. Serum dilutions of histamine, ranging from 100 g to 1000 g were tested. A dose response was observed. (Authors). 000677.

000184

Gupta, K. C., Bishop, D. H. L., Roy, P.

1979. 5'-terminal sequences of spring viremia of carp virus RNA synthesized in vitro. J. Virol. 30(3):735-745. (Dep. Public Health, Dep. Microbiol. Univ. Alabama in Birmingham, The Med. Cent. Birmingham, Ala. 35294.).

A molecular biological study of the RNA of spring viremia of carp. The disease is in no way discussed in this report. (Ken Wolf). 000651.

000185

Hazen, T. C., Fliermans, C. B.

1979. Distribution of *Aeromonas hydrophila* in natural and man-made thermal effluents. Appl. Environ. Microbiol. 38(1):166-168. (Biol. Dep. Wake Forest Univ. Winston-Salem, N.C. 27109.).

Densities of *Aeromonas hydrophila* showed distinct thermal optima (25 to 35 °C) and thermal maxima (45 °C) when measured along thermal gradients created by geothermal and nuclear reactor effluents. Survival of *A. hydrophila* never exceeded 48 h at temperatures of > 45 °C. Thermophilic strains could not be isolated at any site. (Authors). 000738.

000186

Hendricks, J. D., Sinnhuber, R. O., Loveland, P. M., Pawlowski, N. E., Nixon, J. E.

1980. Hepatocarcinogenicity of glandless cottonseeds and cottonseed oil to rainbow trout (*Salmo gairdnerii*). Science (Wash. D.C.) 208(4441):309-311. (Dep. Food Sci. Technol. Oregon State Univ. Corvallis, Ore. 97331.).

Glandless cottonseed kernels are available for purchase and consumption by the general public. These kernels contain no gossypol but still have a full complement of naturally occurring cyclopropanoid fatty acids, which in rainbow trout are active as synergists with aflatoxins and primary liver carcinogens. Diets containing glandless cottonseed kernels or a lightly processed cottonseed oil produced significant numbers of hepatocellular carcinomas in rainbow trout after 1 year. The much greater incidence of cancer induced by the kernel than by the oil indicates that synergists or other carcinogens may be present in the kernel in

addition to the cyclopropanoid fatty acids. (Authors). 000721.

000187

Hickey, C. R. Jr., Samworth, R. B.

1979. Non-radiological consequences to the aquatic biota and fisheries of the Susquehanna River from the 1979 accident at Three Mile Island Nuclear Station. U.S. Nucl. Regulatory Comm. Washington, D. C. NUREG-0596. 98 pp. (Div. Site Safety Environ. Analysis, Off. Nucl. Reactor Regul. U.S. Nucl. Regulatory Comm. Washington, D. C. 20555.).

This is a review of Section C, pages 49-55, dealing with fish disease, parasites, and mortalities.

Typical ecological values in the Susquehanna River were studied from 1967 to 1974. The nuclear power station on Three Mile Island became operational in 1974 and from that time more detailed chemical and ecological records were kept. These records were used as a basis to compare and evaluate changes which resulted from the accident of 28 March 1979.

Among the data which were analyzed, the following fish parasites and diseases were studied: leeches, copepods, branchiurans (*Argulus*), black-spot disease; acanthocephalans, myxosporidians, and nematodes, as well as abnormalities and mortalities. The authors concluded that no unusual conditions of fish disease or mortalities were noted following the accident. (S. F. Snieszko). 000685

000188

Hikida, M., Wakabayashi, H., Egusa, S., Masumura, K.

1979. *Flexibacter* sp. a gliding bacterium pathogenic to some marine fishes in Japan. Bull. Jpn. Soc. Sci. Fish. 45(4):421-428. (Dep. Fish. Fac. Agric. Univ. Tokyo, Bunkyo-ku, Tokyo 113, Japan.).

A new bacterial disease, bringing about mass mortality of cultured juvenile red sea bream (*Pagrus major*) and black sea bream (*Acanthopagrus schlegelii*) in Hiroshima prefecture, was found to be due to a kind of gliding bacterium.

In the present study, eight strains of gliding bacteria isolated from diseased juvenile red sea breams and black sea breams were studied on their morphological, biochemical, and physiological characteristics.

All strains were gram-negative, flexuous rods which exhibited gliding motility without flagella, and usually about 0.5  $\mu\text{m}$  by 2 to 30  $\mu\text{m}$ . Filamentous cells measuring up to 100  $\mu\text{m}$  in length were occasionally found. The organisms showed no anaerobic growth and did not produce microcysts. They utilized none of the 24 kinds of carbohydrates tested. Polysaccharides such as agar, cellulose, and chitin were not decomposed. The guanine plus cytosine proportional content in the DNA was 31.3 to 32.5%. The organisms grew in media prepared with sea water or a synthetic sea water, but did not in those with NaCl alone. On the basis of these characteristics, it was considered that the present organisms should be placed in the genus *Flexibacter*. The organism was found to be distinct in its various characteristics and pathogenicity to fish from any formerly established species of the genus *Flexibacter*, and, therefore, it was classified as a new species. (Authors). 000707.

000189

Hiraki, S., Mulcahy, M. F., Dmochowski, L.

1978. Particle-filament complex in tumor cells of northern pike, *Esox lucius* L. Tex. Rep. Biol. Med. 36:111-120. (Dep. Virol. Univ. Texas Syst. Cancer Cent. M.D. Anderson Hosp. Tumor Inst. Tex. Med. Cent. Houston, Tex. 77025.).

Examination of the cells of lymphoreticular neoplasms of the northern pike (*Esox lucius* L.) by electron microscopy has demonstrated the presence of unusual cytoplasmic crystalloid inclusions in cells of a spontaneous trunk tumor. The ultrastructural analysis revealed that the inclusions are composed of parallel arrays of filaments associated with rows of particles. This is designated as 'particle-filament complex'. The filaments of the complex measured 90-120A in diameter and 0.6-2.8  $\mu\text{m}$  in length. A row of dense particles measuring 250A in diameter was arranged in regular manner between the parallel filaments. It is of interest that the complex was always accompanied by an unusual structure of nucleus of the tumor cell. The nuclei were composed entirely of filaments which were distorted and closely packed. The significance of the particle-filament complex associated with altered nucleus remains to be determined. (Authors). 000726.

000190

Hoffman, G. L., Kazubski, S. L., Mitchell, A. J., Smith, C. E.

1979. *Chilodonella hexasticha* (Kiernik, 1909) (Protozoa, Ciliata) from North American warm-water fish. J. Fish Dis. 2(2):153-157. (Fish Farming Exp. Stn. P. O. Box, 860, Stuttgart, Ark. 72160.).

First report of *Chilodonella hexasticha* from North America. Specimens were taken from the first case on *Ictalurus nebulosus* and from *Carasius auratus* and compared with *C. cyprini* and *C. hexasticha* from Europe. Severe hyperplasia and fusion of gill lamellae are caused by *C. hexasticha*. The pathologic changes are described and illustrated. (Ken Wolf). 000689.

000191

Horiuchi, M., Nakata, M., Kohga, K.

1979. A new cell line from carp sac-fry. Bull. Jpn. Soc. Sci. Fish. 45(2):147-151. (Nihon Nosan Kogyo Co. Ltd. Res. Cent. Midori-ku, Yokohama, Japan.).

An attempt was made to obtain the primary cell line from carp sac-fry (*Cyprinus carpio*) with high growth rate and without cotamination.

Eggs just before hatching were incubated in still-water under aeration in a glass vessel. To avoid contamination by fungi and bacteria, malachite green and nifurprazine-HCl were added in a low concentration to the incubating water. The sac-fries just hatched were pooled in a petri dish and washed several times with Earle's BSS containing penicillin (250 units per mL), streptomycin (250  $\mu\text{g}$  per mL), kanamycin (25  $\mu\text{g}$  per mL) and fungizone (12.5  $\mu\text{g}$  per mL). After chopping the fries into small pieces cells were dispersed with pronase-P (0.01% in Eagle's MEM) at room temperature. The cells at a concentration of  $1-1.5 \times 10^7$  cells per mL were cultivated in Eagle's MEM with 10% fetal bovine serum (GM-10) at 30°C. For subcultivation primary cells grown to confluent monolayers were dispersed by EDTA-trypsin solution at room temperature.

After 3 to 4 days cell sheets of mixed epithelium-like and fibroblast-like cells became confluent. As time passed, epithelium-like cells became dominant. The cells grew at 15 to 37°C. At 30°C the cells could be subcultured at 4 to 7 day intervals. The cells maintained at 15°C could be subcultured at 2 to 3 month intervals. The cells grew well in Eagle's MEM with 5% calf serum as well as in GM-10. At a concentration of  $3-4 \times 10^6$  cells per mL, the cells in GM-10 added 10% DMSO could be preserved by freezing at -80 °C for at least 1



month. The cells could not support the replication of IPN virus. This primary cell designated as CSF cell has been subcultured 42 times over a period of 24 months. (Authors). 000749. (Paper in Japanese)

000192

Ikeda, K.

1978. Immune response of rainbow trout to killed and live *Aeromonas salmonicida*. Bull. Freshw. Fish. Res. Lab. (Tokyo) 28(1):47-53. (Freshw. Fish. Res. Lab. Fish. Agency, Tokyo, Japan.).

The immune response of rainbow trout was studied individually after a single intraperitoneal injection of formalin-killed and less-virulent live *Aeromonas salmonicida*. In all individuals at 4 weeks after injection of the live antigen, the agglutinin titer was higher. Many individuals at 4 weeks after injection of the killed antigen had a higher agglutinin titer value, but there were a few individuals with a lower or no immune reaction in spite of the same administration. These different responses to the killed bacterial antigen are attributable to the shortage of the amount of antigen administered. The high level of agglutinin was maintained for a long period after each injection of both the formalin-killed and live antigen. (Author). 000720. (Paper in Japanese)

000193

Ikeda, K.

1978. Gel chromatographical characteristics of agglutinating antibody of rainbow trout to *Aeromonas salmonicida*. Bull. Freshw. Fish. Res. Lab. (Tokyo) 28(1):55-60. (Freshw. Fish. Res. Lab. Fish. Agency, Miya, Hino-shi, Tokyo, Japan.).

Gel chromatographical characteristics of the agglutinating antibody of rainbow trout to *Aeromonas salmonicida* were studied. Anti-A. *salmonicida* rainbow trout serum was fractionated on Sephadex G-200, Sepharose 6B and Sepharose 4B (equilibrated in 0.01M phosphate buffer pH 7.2 with 0.15M NaCl plus 0.02% sodium azide) in column (100 × 2.6 cm) at 4°C. These fractions were measured at an optical density of 280 nm, and assayed for antibody activity. The molecular weight of agglutinating antibody was found to be approximately 800,000 by gel filtration. A low-molecular antibody was not detected. (Author). 000691. (Paper in Japanese)

000194

Inebi, W., Horne, M. T.

1979. A complement-fixation method for the detection of *Vibrio*-specific antibodies in rainbow trout, *Salmo gairdneri* Richardson. J. Fish Dis. 2(2):159-160. (Dep. Biol. Univ. Stirling, Scotland.).

Four bacterins were each tested in 12 to 15 trout, and their sera were assayed at weekly intervals for agglutination and complement fixation titers. With three of the bacterins, CF titers were measurable at 1 week while it took 3 to 4 weeks for development of measurable agglutinin titers. The best bacterin produced titers measurable with either method at 1 week, but the CF titer was greater by a factor of four dilutions. (Ken Wolf). 000688.

000195

Isaacson, P. A., Morrisson, N. J. III.

1980. Occult hemoglobin as an indicator of impingement stress in fishes. Prog. Fish-Cult. 42(1):9. (Off. Environ. Planning, New York State Dep. Publ. Serv. 3 Rockefeller Plaza, Albany, N. Y. 12223.).

Commercial test strips for occult hemoglobin gave a strongly positive reaction when tested on several species of fish that had been recently killed by impingement on intake screens. The test strips did not show a reaction with freshly caught shiners but gave a maximal reaction 2 to 4 min after capture. The authors suggest that the test strips may be too sensitive. (Ken Wolf). 000675.

000196

Jilek, R.

1979. Histopathology due to the presence of *Gracilisentis gracilisentis* in *Dorosoma cepedianum* (Le Sueur). J. Fish Biol. 14(6):593-595. (Dep. Zool. Cent. Lake Erie Area Res. (CLEAR), The Ohio State Univ. Columbus, Ohio 43210.).

The acanthocephalan, *Gracilisentis gracilisentis*, infects the pyloric caeca and small intestine of *Dorosoma cepedianum*. Sections of intestinal tissue were examined microscopically and indicated pathological lesions were produced by *G. gracilisentis* in the mucosa and submucosa. *Gracilisentis gracilisentis* occurs during the period of seasonal



mortalities of *D. cepedianum* and may be responsible for such mortalities. (Author). 000714.

000197

Kerebel, B., Le Cabellec, M. T., Kerebel, L. M.

1979. Structure and ultrastructure of intravital parasitic destruction of the external dental tissue in the fish, *Anarhichas lupus* L. Archs. Oral Biol. 24:147-153. (F.R.A. INSERM, Fac. de Chirurgie Dentaire, 1 Place Alexis Ricordeau, 44042 Nantes, France.).

Three specimens of *Anarhichas lupus* L. with teeth presenting burrowing lesions were studied with light microscopy, SEM, and high resolution TEM. Findings suggested that the lesions were due to fungoid invasion by *Mycelites oesifragus*. The burrowing lesions always originated in the more highly mineralized external tooth layer, thus distinguishing them from post-mortem soil changes which may start in any part of the tooth. The channels produced by the lesion had no particular orientation to the dentinal vascular canals. It is suggested that enzymes are secreted locally by the causal organism; burrows were thus not found at a distance from the fungus whose numerous microvilli were in close contact with the mineralized walls of the channels; this distinguishes the lesion from dental caries. Needle-shaped crystals are found within the cytoplasm or adherent to the plasma membrane of the burrowing organism. Other crystals in the immediate neighborhood of the organism were hollow, and thus suggestive of an organism feeding on mineral material. Bacterial invasion was sometimes in association with the burrowing activity, and may play a part in it, but often appeared to be a later invasion. (Authors). 000731.

000198

Kimura, T., Yoshimizu, M., Atoda, M.

1980. Disinfection of hatchery water supply by ultraviolet (U. V.) irradiation — III. effect of disinfection of hatchery water supply by ultraviolet irradiation on hatching rate of salmonid eggs. Fish Pathol. 14(3):139-142. (Lab. Microbiol. Fac. Fish. Hokkaido Univ. Hakodate, Hokkaido, Japan.).

The effect of ultraviolet disinfection ( $22-63 \times 10^3 \mu\text{W}\cdot\text{sec}/\text{cm}^2$ ) of water supply on hatching rate of salmon eggs, masu salmon (*Oncorhynchus masou*) and chum salmon (*O. keta*) were examined. The results obtained are summarized as follows:

1. Viable bacterial counts were decreased about 90% in ultraviolet treated water, but viable fungi counts did not decrease to the same degree as the bacterial counts.

2. The eyeing rate and hatching rate were about 20% higher in the ultraviolet treated hatching tray than the untreated control, the fungi infection rate of the egg decreased about 19%.

3. Utilization of disinfection of hatchery water supply by ultraviolet irradiation was expected to increase the eyeing rate and the hatching rate. (Authors). 000713. (Paper in Japanese)

000199

Kimura, T., Yoshimizu, M., Tajima, K., Ezura, Y.

1980. Disinfection of hatchery water supply to ultraviolet (U. V.) irradiation — II. U.V. susceptibility of some fish pathogenic fungi. Fish Pathol. 14(3):133-137. (Lab. Microbiol. Fac. Fish. Hokkaido Univ. Hakodate, Hokkaido, Japan.).

Cidal effect of ultraviolet irradiation on 10 strains of fish pathogenic aquatic fungi and six species of bacteria including fish pathogens were examined.

The results obtained are summarized as follows: (1) The punched agar medium disk covered with fungus hyphae was employed for the measurement of susceptibility to ultraviolet irradiation of aquatic fungi. The hyphae of 10 strains of aquatic fungi, i.e. *Saprolegnia parasitica* IFO 8978 etc. show relatively lower susceptibility to ultraviolet irradiation compared with the bacteria. The minimal fungicidal dosage of ultraviolet irradiation, inhibition of growth of hyphae was  $154 \sim 252 \times 10^3 \mu\text{W} \cdot \text{sec}/\text{cm}^2$ . (2) This dosage was about 50 times higher than the minimal bactericidal dosage of ultraviolet irradiation for destruction, at least 99.9% of viable bacterial cells. (Authors). 000693. (Paper in Japanese)

000200

Kirmse, P.

1980. Observations on the pathogenicity of *Haemogregarina sachai* Kirmse, 1978, in farmed turbot *Scophthalmus maximus* (L.). J. Fish Dis. 3(2):101-114. (Unit of Aquatic Pathobiol. Univ. Stirling, Stirling FK9 4LA, Scotland.).

Cultured turbot *Scophthalmus maximus* (L.) from three farms at Hunterston, Scotland were

found to be infected with *Haemogregarina sachai*. Up to 6% of some populations were affected with gross tumorous lesions of the musculature and viscera. The lesions consisted of necrotic tissue with a caseous center. Histologically, there was an accumulation of parasitized reticulo-endothelial cells, cell debris and pyknotic nuclei. Parasitaemias of up to 36% of all blood cell types were observed. The majority of infected cells were neutrophils and monocytes. Infected leucocytes were hypertrophied. There was an erythrocytopenia of infected fish with increases in erythroblasts, monocytes and neutrophils but a decrease in thrombocytes and lymphocytes. Transmission experiments between fish were unsuccessful. (Author). 000754.

000201

Kitaue, K.

1980. Intestinal giant-cystic disease affecting the carp, caused by *Thelohanellus* sp. Fish Pathol. 14(3):145-146. (Ibusuki Br. Kagoshima Pref. Fish Exp. Stn. Ibusuki, Kagoshima, Japan.).

00710. (Paper in Japanese)

000202

Koch, E. A., Dolowy, W. C., Spitzer, R. H., Greenberg, S., Brown, E. R.

1976. Postulated developmental forms in the life cycle of the lymphocystis virus. Cancer Biochem. Biophys. 1:163-166. (Dep. Biochem. Microbiol. Pathol. Univ Health Sci. The Chicago Med. Sch. Chicago, Ill. 60612.).

Electron micrographs of lymphocystis skin lesions obtained from the walleye pike, *Stizostedion vitreum*, show viral particles of differing sizes and morphologies. Earlier studies have described only particles ranging in size from 200-250 m $\mu$  in diameter. We show, in addition, new forms (65 to 100 m $\mu$  in diameter) intermingled among the large particles and also contained within the latter. Both forms are associated with a single inclusion body. The possible role of the small particle in the life cycle of the virus is discussed. (Authors). 000679.

000203

Koelbl, O., Kainz, E.

1977. The distribution of pathogens of infectious stomach dropsy in Austrian carp pond

farms. (Die Verbreitung des Erregers der infektiösen Bauchwassersucht bzw. der Frühlingsvirame in den österreichischen Karpfenteichwirtschaften.) Oesterr. Fisch. 30(5/6):80-83. (Bundesanst. Viruseuchenbekämpfung. Haustiere, Vienna, Austria.).

Studies have shown that *Rhabdovirus carpio* is widely distributed in Austria. Whether this is the case in other bordering countries must be doubted on the basis of studies of imported fish. In the present situation the changes of successful suppressive action are small. Carp, which cannot be immunized under favorable conditions (i. e. in summer) are in great danger. If infection takes place in the winter months, which can easily be the case because of the wide distribution of the pathogen, then large losses can occur in Spring. In general, however, carp are immunized in the summer months because of the chronic infection of farms with *R. carpio*. The uncontrolled progressive immunization prevents the outbreak of the acute form of the IBW in Spring. It should be considered whether it would not be preferable to vaccinate with apathogenic *R. carpio* strains of the uncontrolled disease. Studies on the feasibility of this are in progress. (Authors). 000740. (Paper in German)

000204

Krantz, G. E.

1970. Lymphocystis in striped bass, *Morone saxatilis*, in Chesapeake Bay. Chesapeake Sci. 11(2):137-139. (U.S. Fish Wildl. Serv. Bur. Commer. Fish. Biol. Lab. Oxford, Md. 21654.).

The report documents susceptibility of striped bass to lymphocystis disease. (Ken Wolf) 000735.

000205

Krantz, H., Peters, N., Bresching, G., Stich, H. F.

1980. On cell kinetics in skin tumors of the Pacific English sole *Parophrys vetulus* Girard. J. Fish Dis. 3(2):125-132. (Zool. Inst. Univ. Hamburg. Martin-Luther-King-Platz 3, 2000 Hamburg 13, Fed. Rep. Germany.).

An autoradiographic study of the various types of neoplastic lesions in the skin of Pacific English sole *Parophrys vetulus* Girard was performed using peritoneally injected tritiated thymidine. The epidermis of fish is mitotically active at all cell levels, the most important being the supra-basal layer. In the hyperplastically growing epidermis of the English sole covering connective tissue nodules and in

the papillating epidermis prior to formation of enlarged ovoid cells (X-cells), the suprabasal layer also shows the greatest degree of labelling. Parallel to the appearance of these X-cells, which are characteristic of the skin tumors in Pacific flatfish, the distribution of DNA-synthesizing cells is altered. In the tumor areas which are more or less filled with X-cells the 'envelope cells' are labelled throughout with a uniform frequency. On the other hand, the directly adjacent X-cell free areas are labelled with a greater than average frequency. (Authors). 000753.

000206

Kusuda, R., Sako, H., Kawai, K.

1979. Classification of vibrios isolated from diseased fishes — I. on the morphological, biological and biochemical properties. Fish Pathol. 13(3):123-137. (Dep. Cult. Fish. Fac. Agric. Kochi Univ. Nangoku, Kochi, Japan.).

The results of a taxonomical study of 50 *Vibrio* strains isolated from several diseased fishes: yellowtail (*Seriola quinqueradiata*), kampachi (*Seriola purpurascens*), red sea bream (*Chrysophrys major*), black sea bream (*Mylio macrocephalus*), amago (*Oncorhynchus rhodurus* f. *macrostomus*), ayu (*Plecoglossus altivelis*) and eel (*Anguilla japonica*), and 21 allied reference strains show that the fish pathogenic vibrios can be divided into three major groups.

Group I, *Vibrio anguillarum* are also subdivided into three subgroups according to their source, whether host fish have been affected in sea water, estuarine water or fresh water.

Group II including *Vibrio* sp K-3 have a close relationship to *Vibrio parahaemolyticus*, but are distinguishable from group I, *V. anguillarum*.

Group III isolated from red sea bream in winter, seem to be pathogenic in the season of low water temperature, and in connection with *V. ichthyodermis*.

Comparing some characteristic features of each group, a diagnostic scheme useful for rapid identification is given. (Authors). 000757. (Paper in Japanese)

000207

Liao, I. C., Yang, F. R., Lou, S. W.

1978. Preliminary report of effect of Panfuran-S bath on the survival and growth of milkfish fry. Joint Comm. Rural Reconstr. Fish. Ser.

34:89-95. (Tungkang Mar. Lab. Taiwan Fish. Res. Inst. Pingtung, Taiwan 916.).

In Taiwan, lots of milkfish fry for culture are imported from Southeast Asia. The imported milkfish fry are not allowed to get through customs unless they have been treated with Panfuran-S bath. However, according to culturists' experiences, those treated fry do not grow well. Thus in 1976 and in 1977 this study was undertaken with the purpose to find out the effect of Panfuran-S bath on milkfish fry. The 24-h TLM of Panfuran-S for milkfish fry is 6.4 ppm. The results also indicate that the health condition of milkfish fry seems to be related to the effect of Panfuran-S bath. (Authors). 000722. (Paper in Chinese)

000208

Lieberman, D., Early, G.

1979. *Exophiala*-like fungus in an alewife *Alosa pseudoharengus*. Drum and Croaker 19(2):37-39. (New England Aquarium, Boston, Mass. 02109.).

An alewife, *Alosa pseudoharengus*, from a captive school in a marine display tank at the New England Aquarium revealed an *Exophiala*-like fungus on histopathologic section of the cardiac tissue. Naturally-occurring cases of *Exophiala*, also from public aquarium display tanks, have been reported in eight genera of captive fish, and the infection has been experimentally reproduced in six genera of fish. Histologic techniques as an addition to standard aquarium postmortum procedures proved to help in obtaining information. (Authors). 000674.

000209

Lovell, T.

1979. Brown blood disease in pond-raised catfish. Comm. Fish Farmer 5(3):33. (Dep. Fish. Allied Aquacult. Auburn Univ. Auburn, Ala. 36830.).

Brown blood disease is a noninfectious but debilitating condition that can cause high mortality among channel catfish of fingerling to adult size. The disease is a problem among fish that have been intensively fed in ponds that are not drained. The onset occurs when fall temperatures drop and remain low. Nitrite toxicity resulting in methemoglobinemia, may be causal, and there has been experimental induction of brown blood with nitrate or nitrite—the text is not clear. Investigator's

names and locations are given, but there are no references. (Ken Wolf). 000672.

000210

Madhavi, R.

1978. Life history of *Genarchopsis goppo* Ozaki, 1925 (Trematoda: Hemiuridae) from the freshwater fish *Channa punctata*. J. Helminthol. 52:251-259. (Dep. Zool. Andhra Univ. Waltair 530003, India.).

The life cycle of *Genarchopsis goppo* a hemiurid trematode found in the stomach of *Channa punctata* has been worked out in detail. The egg contains a fully developed miracidium at the time of liberation. The miracidium contains a ciliated covering, a long apical gland and a crown of spines at the anterior end. The snail *Amnicola travancorica* acts as the first intermediate host inside which the miracidium passes through sporocyst and redial generations. The cercaria is of cystophorous type and is identical to Cercariae Indicae Sewell XXXV. Metacercaria occurs in the ostracods *Stenocypris malcolmsoni* and *Eucypris capensis*. The fish *Aplocheilichthys panchax* serves as the paratenic host. The entire developmental cycle from egg to egg producing adult takes 3 months. (Author). 000737.

000211

Matumoto, T.

1980. *Caligus orientalis* parasitic on cultured carp. Fish Pathol. 14(3):143-144. (Tottori Pref. Fish Exp. Stn. Iwami, Tottori, Japan.).

An outbreak of *Caligus orientalis* (parasitic Copepoda) occurred in a fish farm of carp, *Cyprinus carpio*, at Tottori Prefecture in summer 1978, and many carp over 1 year of age, in addition to all individuals of 0 age, died. The farm uses water from lake Togo-ike which connects with the Sea of Japan through a passage about 2 km long. In 1978, chlorinity of the water increased from March to September; it was measured 1380 ppm Cl — concentration in March, 4060 ppm in July and 7300 ppm in August in 0.5 m layer at the center of the lake. It is evident that the outbreak of the caligid on carp is attributed to a rise of chlorinity of the water as in a case of crucian carp in Lake Shinzi.

This is the first record of an outbreak of *Caligus orientalis* on carp. (Author). 000694. (Paper in Japanese)

000212

Maurin, J.

1977. Research on the viruses of marine organisms. (Recherche des Virus dans les Organismes Marins.) Rev. Int. Oceanogr. Med. 48:37-45. (Ecole Natl. de la Santa Publique, Lab. Eaux, 35043 Rennes Cedex, France.).

Very little virological work has been done so far on marine organisms, compared to the world they form. As regards fish, the viral nature of lymphocystis has long been known, but up to the moment only a few dozen viruses have been studied and isolated. Methods of work are similar to those used with the upper vertebrates: histological and electron microscopic examination of the organs of the sick animals, virus isolation by inoculation of susceptible animals or cell cultures, and possibly serology. Among the invertebrates, studies are less advanced and limited to some work on crustaceans and molluscs (crabs and oysters). These studies are generally limited to morphological examination by electron microscope; isolation of viruses is not currently made. There is moreover the important problem of the shell-fishes as a reservoir of viruses, pathogenic for men and animals. All these fields will certainly be developed in the future. (Author). 000745. (Paper in French)

000213

McCarthy, D. H., Stevenson, J. P., Salsbury, A. W.

1974. Combined in vitro activity of trimethoprim and sulphonamides on fish-pathogenic bacteria. Aquaculture 3(1):87-91. (MAFF, Fish. Lab. Look-out House, The Nothe, Weymouth, Dorset, England.).

The relative in vitro activity of seven sulphonamides, Sulphadiazine, Sulphanilamide, Sulphadimidine, Sulphamerazine, Sulphathiazole, Sulphamethoxypyridazine, Sulphamethylphenazole, each linked in turn to trimethoprim, was assessed for representatives of the following fish pathogenic bacteria: *Aeromonas punctata*, *A. salmonicida*, *Vibrio anguillarum*, *Pseudomonas* sp. *Haemophilus piscium*. (Authors). 000728.

000214

Michel, C.

1979. Furunculosis of salmonids: vaccination attempts in rainbow trout *Salmo gairdneri* by formalin-killed germs. (Furunculose des sal-



monides: essais de vaccination de la truite arc-en-ciel (*Salmo gairdneri*) à l'aide de germes tués par le formol.) Ann. Rech. Vet. 10(1):33-40. (Lab. Ichthyopathol. INRA Route de Thiverval 78850 Thiverval-Grignon, France.).

Two immunization trials were performed in rainbow trout, using a formalin killed *Aeromonas salmonicida* suspension. In the first experiment, 200 g fish were administered orally or intraperitoneally. Circulating antibodies were elicited in injected animals only, but no protection was found when they were challenged with a highly virulent strain. Rough and smooth bacteria have provided similar agglutinins titers. In the second study, fingerlings were vaccinated by injection, but experimental disease was reproduced through IP or IM inoculations. Protection was effective in the second case. In the IP injected group the mortality was the same in vaccinated fish and controls, and carriers were detected among survivors 3 months later. The surprising fact is that serum agglutinins did not always provide a protection. This last one depends on different factors such as pathogenicity of strains and route of penetration of the challenge bacteria. So, experimental challenge has to be improved. (Author). 000709.

000215

Mitchell, A. J., Plumb, J. A.

1980. Toxicity and efficacy of Furanace on channel catfish *Ictalurus punctatus* (Rafinesque) infected experimentally with *Aeromonas hydrophila*. J. Fish Dis. 3(2):93-99. (U.S. Fish Wildl. Serv. Fish Farm. Exp. Stn. P. O. Box 860, Stuttgart, Ark. 72160.).

The 96-h medium tolerance limit of Furanace (nifurpirinol; P-7138) for channel catfish *Ictalurus punctatus* at 21°C was 0.94 mg per liter. The most effective treatment level for channel catfish, experimentally infected with *Aeromonas hydrophila*, was 2 mg per liter for 6.5 h. Furanace at 0.5 and 1.0 mg per liter in brain heart infusion agar reduced in vitro growth of *A. hydrophila* and at 2.0 mg per liter growth was completely inhibited. In vitro drug resistance was observed. (Authors) 000755.

000216

Nagabayashi, T., Wolf, K.

1979. Characterization of EV-2, a virus isolated from European eels (*Anguilla anguilla*) with stomatopapilloma. J. Virol. 30(1):358-364.

(Kitasato Univ. Sch. Fish. Sci. Sanriku-cho, Kesen-Gun, Iwate Prefecture, 022-01, Japan.).

000217

Nishibuchi, M., Muroga, K.

1980. Pathogenic *Vibrio* isolated from cultured eels — V. Serological studies. Fish Pathol. 14(3):117-124. (Fac. Applied Biol. Sci. Hiroshima Univ. Fukuyama, Japan.).

Serological relationships among the strains of pathogenic *Vibrio* isolated from cultured eels and between the eel isolates and the species of the genus *Vibrio* were studied by means of Ouchterlony immunodiffusion techniques and agglutination-adsorption tests with rabbit antisera prepared against representative strains of the present isolates. The present eel isolates were antigenetically very homologous. All five representative isolates produced four lines of identity in Ouchterlony plates, and possessed agglutinins (flagellar and at least one heat-stable antigen) in common. The species of the genus *Vibrio* exhibited slight relationships to the eel isolate: *V. anguillarum* strains, *V. parahaemolyticus* strain, and *V. alginolyticus* strain shared one precipitin band with the present eel isolate, and *V. anguillarum* strains, *V. fischeri* strains, *V. parahaemolyticus* strain, and *V. alginolyticus* strain had agglutinins, most likely flagella antigen, common to the present eel isolate. These results agree with those of the previous DNA studies, and present another piece of evidence that the present eel isolate is a new member of the genus *Vibrio*. (Authors). 000695. (Paper in Japanese)

000218

Nishibuchi, M., Muroga, K., Jo, Y.

1980. Pathogenic *Vibrio* isolated from cultured eels — VI. diagnostic tests for the disease due to the present bacterium. Fish Pathol. 14(3):125-131. (Fac. Appl. Biol. Sci. Hiroshima Univ. Fukuyama, Japan.).

A search was made for the diagnostic test for the disease of cultured eels due to the present bacterium.

It is considered impossible to differentiate the disease of eels caused by the present bacterium, by means of external signs of diseased fish, from that caused by other eel pathogens such as *Aeromonas hydrophila*, *Edwardsiella tarda*, *Vibrio anguillarum*, and *Pseudomonas anguilliseptica*. This necessitates the isolation and identification of the infectious agent for diagnosis.



Positive proof was obtained that the diluted rabbit antisera prepared against representative strains of the present bacterium can be used for diagnostic purposes. In addition, a simplified identification method by the use of API 20E was shown.

It was proposed that the disease of cultured eels caused by the present *Vibrio* be named as vibriosis of eels Type B; that due to *V. anguillarum* as Type A. (Authors). 000712. (Paper in Japanese)

000219

Overman, T. L.

1980. Antimicrobial susceptibility of *Aeromonas hydrophila*. Antimicrob. Agents Chemother. 17(4):612-614. (Pathol. Serv. Veterans Admin. Med. Cent. Lexington, Ky. 40507.).

Minimal inhibitory concentration determinations and disk diffusion and Autobac 1 susceptibility tests were performed on 22 strains of *Aeromonas hydrophila*. Eleven of the strains had discrepancies between Autobac and disk diffusion or minimal inhibitory concentration results. These discrepancies occurred with the beta-lactam antibiotics, primarily carbenicillin and cephalothin. It is recommended that any strain of *A. hydrophila* found to be susceptible to any of the beta-lactam antibiotics by using Autobac 1 should be retested by a disk diffusion or minimal inhibitory concentration method. (Author). 000719.

000220

Paperna, I., Baudin Laurencin, F.

1979. Parasitic infections of sea bass, *Dicentrarchus labrax*, and gilt head sea bream, *Sparus aurata*, in mariculture facilities in France. Aquaculture 16(2):173-175. (H. Steinitz Mar. Biol. Lab. Hebrew Univ. Jerusalem, Elat, Israel.).

Parasitic infections occur in sea cultured *Sparus aurata* and *Dicentrarchus labrax* in France. Investigations indicate the presence of parasitic protozoans, monogeneans and copepods in these fish. (Authors). 000653.

000221

Pickering, A. D., Willoughby, L. G., McGroarty, C. B.

1979. Fine structure of secondary zoospore cyst cases of *Saprolegnia* isolates from infected fish. Trans. Br. Mycol. Soc. 72(3):427-436. (Freshw. Biol. Assoc. Ferry House, Far Sawrey, Near Ambleside, Cumbria, England.).

The secondary zoospore cyst cases of *Saprolegnia* isolates from 34 infected fish were examined by means of the transmission electron microscope. Isolates identified from their sexual characters as *S. diclina* Humphrey Type 1 produced secondary zoospore cysts each bearing bundles of long, hooked-hairs whereas isolates of *S. diclina* Type 2 produced secondary zoospore cysts with short, single, hooked-hairs. A typical saprophytic strain of *S. diclina* Type 3, also produced secondary zoospore cysts with short, single, hooked-hairs. Isolates from infected fish which had hitherto been impossible to identify because of their failure to develop sexual organs produced secondary zoospore cyst cases similar in structure to those of *S. diclina* Type 1.

Within the variation of secondary cyst characteristics for *S. diclina* Type 1 and the sexually sterile *Saprolegnia* isolates, significant relationships were found between the length of the hooked-hairs, the number of hooked-hairs per bundle and the distance between the bundles of hooked-hairs on the cyst. The apparent trend towards an increase in length of these hooked-hairs and their aggregation into bundles is discussed in relation to the parasitic mode of life of these fungi. (Authors). 000727.

000222

Pierce, K. V., McCain, B. B., Wellings, S. R.

1980. Histopathology of abnormal livers and other organs of starry flounder *Platichthys stellatus* (Pallas) from the estuary of the Duwamish River, Seattle, Washington, U.S.A. J. Fish Dis. 3(2):81-91. (Environ. Conserv. Div. Northwest Alaska Fish. Cent. Natl. Mar. Fish. Serv. 2725 Montlake Blvd. East, Seattle, Wash. 98112.).

Starry flounder *Platichthys stellatus* (Pallas) from the Duwamish River estuary, which has received large volumes of pollutants in the past, and starry flounder from two relatively unpolluted reference areas were examined for pathological conditions. Gross and microscopic examination of starry flounders from the Duwamish River estuary revealed one or more of the following unusual liver characteristics in 92% (monthly range 85-100%) of the fish: liver discoloration, liver enlargement,

severe fatty vacuolation of the hepatocytes, centrilobular cellular degeneration and necrosis of hepatocytes, megalocytic hepatocytes, proliferating perivascular fibroblasts displacing adjacent liver parenchyma, hepatic structural disarray and increased basophilia of hepatocytes in localized areas. Livers of starry flounders, usually spent spawners from one of the reference areas also had one or more of these characteristics, although at a much lower frequency (<13%), and these included liver discoloration, increased fatty vacuolation of the hepatocytes and hepatic structural disarray. (Authors). 000756.

000223

Raibaut, A., Ben Hassine, O. K., Prunus, G.

1975. Study of the infestation of *Mugil* (*Mugil cephalus* Linne, 1758 (Pisces, Teleostei, Mugilidae) by the copepod *Ergasilus nanus* van Beneden, 1870 in lake Ischkeul (Tunisia). (Etude de l'infestation de *Mugil* (*Mugil cephalus* Linne, 1758 (Poissons, Teleostei, Mugilidae) par le copepode *Ergasilus nanus* van Beneden, 1870 dans le lac Ischkeul (Tunisie).) Bull. Soc. Zool. Fr. 100(4):427-437. (Lab. Biol. Anim. Fac. Sci. Campus Univ. El Menzah, Tunis, Tunisia.).

The study of the seasonal changes of the infestation of *Mugil cephalus* by *Ergasilus nanus* in lake Ischkeul reveals the greatest growth of the parasite towards the end of spring, when the salinity of the water is the lowest, the temperature being high. During that period, the infestation inside the lake is greatly heterogeneous. Besides, it is proved the number of copepods increases with the size of the host, while on a level with the gills, one can notice a decrease of frequency from the first to the fourth branchial arch. Yet, the frequencies of the first and second arches are far higher than those of the third and chiefly of the fourth arch. (Authors). 000659. (Paper in French)

000224

Raibaut, A., Coste, F., Hassine, O. K. B.

1979. *Colobomatus labracis* Delamare Deboutteville and Nunes, 1952 (Copepoda, Philichthyidae), a parasite of the sea bass *Dicentrarchus labrax* (Linne, 1758) from western Mediterranean Sea. (*Colobomatus labracis* Delamare, Deboutteville et Nunes, 1952 (Copepoda, Philichthyidae), parasite du loup *Dicentrarchus labrax* (Linne, 1758) en Mediterranee occidentale.) Z. Parasitenkd. 59:79-85. (Lab. Ichthyol. Parasitol. Gen. Univ. Sci. Tech. Lang-

uedoc, Place E. -Bataillon, F-34060 Montpellier Cedex, France.).

*Colobomatus labracis* Delamare Deboutteville and Nunes, 1952, is a parasitic copepod of the sea bass, *Dicentrarchus labrax* (Linne, 1758) of which only one female parasite has been entirely described up till now. That species is abundantly collected on sea bass from the lagoons of Languedoc (France) and from the lake of Tunis. The complete morphology of the male and female is given. (Authors). 000644. (Paper in French)

000225

Raibaut, A., Essafi, K.

1979. Descriptions of two new species of parasitic copepods of Tunisian selachians. (Description de deux especes nouvelles de Copepodes parasites de Selaciens de Tunisie.) Bull. Mus. Natl. Hist. Nat. 1(2):435-443. (Lab. Ichthyol. Parasitol. Gen. Univ. Sci. Tech. Languedoc, place E. Bataillon, 34060 Montpellier Cedex, France.).

In this study are described two new species of parasitic Copepods, *Eudactylina rhinobati* and *Pseudocharopinus pteromyiae* collected on selachii from southern Tunisia. Their systematic position is discussed. (Authors). 000662. (Paper in French)

000226

Raibaut, A., Maamouri, K.

1975. Remarks on two species of copepods parasitic on selachians of Tunisia. (Remarques sur deux especes de Copepodes parasites de Selaciens de Tunisie.) Bull. Mus. Natl. Hist. Nat. Zool. 3(320):1037-1047. (Lab. Biol. Anim. Fac. Sci. Campus Univ. El Menzah, Tunis, Tunisia.).

Two species of parasitic copepods, *Charopinus dubius* T. Scott, 1900, and *Pseudocharopinus malleus* (Nordmann, 1832), were reported for the first time in Tunisia. Detailed study of *Pseudocharopinus malleus* on different hosts showed that it is identical to *Pseudocharopinus pastinacae* (Van Beneden, 1851). Thus, the latter species should not be considered synonymous with *Pseudocharopinus bicaudatus* (Kroyer, 1837). (Authors). 000661. (Paper in French)

000227

Rao, K. S., Rao, K. V. S. J.

1979. A case report of epidermal tumors on a marine teleost, *Johnius (Johnieops) aneus* (Bloch) from the waters off Visakhapatnam. Curr. Sci. (Bangalore) 48(9):417-418. (Dep. Zool. Andhra Univ. Waltair 530 003, India.).

000664.

000228

Robin, J., Rodrigue, A.

1980. Isolation and preliminary characterization of herpes channel catfish virus DNA. Can. J. Microbiol. 26(2):130-134. (Dep. Biol. Fac. Sci. Univ. Sherbrooke, Sherbrooke, Que. Canada J1K 2R1.).

000699.

000229

Romestand, B., Trilles, J.-P.

1979. Influence of the Cymothoid isopods *Meinertia oestroides*, *Meinertia parallela*, and *Anilocra physodes* (Crustacea; parasites of fish) on the growth of hosts, *Boops boops* and *Pagellus erythrinus* (Sparidae). (Influence des Cymothoïdiens *Meinertia oestroides*, *Meinertia parallela* et *Anilocra physodes* (Crustacés, Isopodes; parasites de poissons) sur la croissance des poissons hôtes *Boops boops* et *Pagellus erythrinus* (Sparides).) Z. Parasitenkd. 59:195-202. (Univ. Sci. Tech. Languedoc, Montpellier, France.).

Studies of weight-size ( $W = aL^b$ ) and growth ( $L = aT^b$ ) in fish (*Boops boops* and *Pagellus erythrinus*), potential hosts of some Cymothoid isopods (*Meinertia oestroides*, *Meinertia parallela*, and *Anilocra physodes*) have been performed. Infested fishes show a slight decrease in weight compared to normal fish. Cymothoid do not exert a significant influence on the weight-size ratio; on the other hand, a delay in growth does occur. (Authors). 000744. (Paper in French)

000230

Ross, L. G., Geddes, J. A.

1979. Sedation of warm-water fish species in aquaculture research. Aquaculture 16(2):183-186. (Unit Aquatic Pathobiol. Univ. Stirling, Stirling FK9 4LA, Scotland.).

Benzocaine sedation is outlined as a routine tool in aquaculture research. The effects of dose level and temperature are demonstrated, and general recommendations for some species of tropical fish are given. (Authors). 000654.

000231

Rydlo, M.

1979. Comparative experiments in the control of *Trichodina* sp. and *Chilodonella cyprini*. (Vergleichende Versuche zur Bekämpfung von *Trichodina* sp. und *Chilodonella cyprini*.) Oesterr. Fisch. 32(11/12):217-222. (Bundesinst. Gewässerforschung Fischereiwirtschaft, Scharfling, A-5310 Mondsee, Austria.).

Carp fingerlings heavily infested with *Trichodina* sp. were comparatively treated with malachite green (0.1 ppm), formalin (30 ppm) and copper sulfate (1 ppm) for 24 h. Treatment with malachite green showed no effect on *Trichodina*, while on fish of groups treated with formalin and copper sulfate no *Trichodina* could be detected.

Rainbow trout fingerlings heavily infested with *Chilodonella cyprini* were comparatively treated with malachite green (0.1 ppm), formalin (20 ppm) and pH 10 (calcium hydroxide) for 24 h. Treatment with formalin and malachite green proved to be most effective. Treatment with pH 10 was not as effective, but also in this group losses were very much reduced in comparison with the untreated control group.

In vitro experiments showed a survival time for *Chilodonella cyprini* less than 16 h in formalin (20 ppm), less than 18 h in pH 10, less than 24 h in malachite green (0.1 ppm) and less than 55 h in tap water (control group). (Author). 000739. (Paper in German)

000232

Sanders, J. E., Fryer, J. L.

1980. *Renibacterium salmoninarum* gen. nov. sp. nov. the causative agent of bacterial kidney disease in salmonid fishes. Int. J. Syst. Bacteriol. 30(2):496-502. (Dep. Microbiol. Oregon State Univ. Corvallis, Ore. 97331.).

Isolates of the kidney disease bacterium, the causative agent of bacterial kidney disease in salmonid fishes, were characterized by the guanine plus cytosine content of the deoxyribonucleic acid, by cell wall sugar composition, and by amino acid composition of the peptidoglycan cell wall layer. The guanine plus cytosine contents of the deoxyri-

bonucleic acids of the isolates were  $53 \pm 0.46$  mol%. Glucose was the principal cell wall sugar detected in each kidney disease bacterium isolate. The major amino acids detected were alanine, glutamic acid, lysine, and glycine. It is proposed that these organisms form a single species belonging to a new genus, for which the name *Renibacterium* is proposed. The type species is *Renibacterium salmoninarum* sp. nov. of which the type strain is Lea-1-74 (= ATCC 33209). This organism is most closely related to the Coryneform Group of Bacteria. (Authors). 000715.

000233

Schlotfeldt, H.-J.

1980. Some clinical findings of a several years survey of intensive aquaculture systems in Northern Germany, with special emphasis to gill pathology and nephrocalcinosis. Pages 1-19 in Symposium on new developments in the utilization of heated effluents and of recirculation systems for intensive aquaculture. EIFAC (Eur. Inland Fish. Advis. Comm.) 11th session, Stavanger, Norway, 28-30 May. (Fish Dis. Contr. Health Serv. Hannover FSGD, Hannover, Bunteweg 17, D 3000 Hannover 71, Fed. Rep. Germany.).

A several years survey of different intensive aquaculture systems in Northern Germany revealed that, with an adequate sanitary and hygienic management as well as combined with a control of the fish origin, bacterial and viral infections have in this kind of fish production units less importance than some environment-dependent systemic conditions. The observed lesions were especially concentrated in the gill and kidney area. The main gill pathology developed from gill swelling with secondary bacterial infections to gill necrosis with important losses. In some cases parasitic invasions complicated the gill situation. Different stages of nephrocalcinosis with secondary gastric complications were observed. Both conditions - gill necrosis and nephrocalcinosis - showed an accentuated water quality and environmental dependence. Generally the lesions showed to be reversible in most cases in which it was possible to improve significantly the environmental conditions and in which the degree of damage did not reach a critical point of irreversibility. (Author). 000747.

000234

Schlotfeldt, H.-J.

1979. Infectious pancreatic necrosis (IPN) of salmonids. Part I. etiology, epizootiology, and control. (Die infektiöse Pankreasnekrose (IPN) der salmoniden. Teil I. Ätiologie, Epizootologie und Bekämpfung.) Tierärztl. Umsch. 34(8):539-546. (Inst. Virol. Tierärztl. Hochschule, Hannover, Fed. Rep. Germany.).

A comprehensive review of the etiology, epizootiology and control of infectious pancreatic necrosis (IPN) of salmonids is presented. The properties of IPN virus (IPNV) and its classification are discussed. The importance of defective interfering (DI) particles is stressed in relation to IPNV carrier fish status, the persistence of IPNV in trout populations and the transmission of virus to progeny and other salmonids. Serological techniques and different strains of IPNV are described. The practical aspects of eradication and control together with the current knowledge on vaccination are discussed in detail. (Author). 000711. (Paper in German)

000235

Schlotfeldt, H.-J., Schoon, H.-A.

1979. Kidney calcification (NC, Nephrocalcinosis or Nephrokalzinosis) of rainbow trout in intensive aquaculture. 1. Clinical course and histopathology. (Nierenverkalkung (NC, Nephrocalcinose oder Nephrokalzinose) der Regenbogenforelle in der Intensivaquakultur. 1. Klinischer Verlauf und Histopathologie.) Tierärztl. Prax. 7:523-528. (Fish Health Serv. Lower Saxony, Bunteweg 17, 3000 Hannover 71, Fed. Rep. Germany.).

A clinical and histopathological study of nephrocalcinosis was carried out on rainbow trout from intensive (silo) aquaculture units maintained on artificial oxygen-supersaturation supply, bore hole water supply and fish stocks of 25-100 kg body weight per m<sup>3</sup> (short term loads up to 180 kg per m<sup>3</sup>). The nephrocalcinosis occurring in these units was compared with that found in the traditional more or less extensive trout pond farms. One of these intensive aquaculture plants showed a heavily loaded environment due to insufficient water supply with severe nephrocalcinosis cases up to 20% of the examined population. This was of economic impact because the carcasses of these fishes were considered to be inedible. Histopathological lesions were confined to kidneys and stomach. Stomach wall lesions were often found in the absence of renal damage. The calcification resulted in deposition of calcium phosphate within necrotic



tissue. The lesions developed were dystrophic and metastatic. The aetiology of the condition is complex and several physico-chemical factors which appear to induce it are briefly discussed. (Authors). 000743. (Paper in German)

000236

Sherburne, S. W., Bean, L. L.

1979. Incidence and distribution of piscine erythrocytic necrosis and the microsporidian, *Glugea hertwigi*, in rainbow smelt, *Osmerus mordax*, from Massachusetts to the Canadian Maritimes. Fish. Bull. 77(2):503-509. (State Maine Dep. Mar. Resour. Fish. Res. Stn. West Boothbay Harbor, Maine 04575.).

Surveys made along the North American coast from Massachusetts to the Canadian Maritime Provinces during late 1976 to late 1977 showed that the incidence of piscine erythrocytic necrosis in populations was high but that the intensity of infection was low. In anadromous smelt, the average incidence was 56%, and in landlocked populations the average was about 2%. Overall, the intensity was < 1% in both. The average incidence of *Glugea hertwigi* was 8% in anadromous and 25% in landlocked smelt. Maps of incidence and distribution and tabular data are given. (Ken Wolf). 000729.

000237

Sindermann, C. J., Ziskowski, J. J., Anderson, V. T. Jr.

1978. A guide for the recognition of some disease conditions and abnormalities in marine fish. U.S. Dep. Commer. Natl. Mar. Fish. Serv. Tech. Ser. Rep. 14. 60 pp. (Natl. Mar. Fish. Serv. Sandy Hook Lab. Northeast Fish. Cent. Highlands, N. J. 00732.).

The following disease conditions are described and illustrated: ulcers, fin erosion, tumors, lymphocystis, black spots, parasitic copepods, skeletal anomalies, reversal in flatfishes, and abnormal pigmentation. (Ken Wolf). 000732.

000238

Sjoblom, V., Kuittinen, E.

1978. Further finds of *Phocascaris* sp. (nematoda) in Baltic herring off the coast of Finland. Int. Counc. Explor. Sea C.M. 1978/J:19. Baltic Fish Comm. 7 pp. Mimeographed. (Finnish

Game Fish. Res. Inst. Fish. Div. P. O. Box 193, SF-00131 Helsinki 13, Finland.).

The search for *Anisakis* on the coast of Finland was continued in 1976 by inspection of 3400 Baltic herring after treatment with citric acid-pepsin. As in the previous year, no *Anisakis* larvae were found.

However, the search revealed 20 larvae of *Phocascaris* sp. first recorded in the Baltic in 1975. The occurrence of *Anisakis* in the Baltic is discussed. (Authors). 000678

000239

Snieszko, S. F.

1980. Epizootiology of fish diseases. (Epizootologie der Fischkrankheiten.) Fisch und Umwelt 8:1-17. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Route 3, Box 50, Kearneysville, W. Va. 25430.).

This is a review paper on the significance and value of epizootiological studies for better understanding of factors that contribute to outbreaks of diseases of fishes. The most important are the genetic makeup of fishes involved, quality of the environment, and the species and pathogenicity of germs or parasites in cases of infectious diseases. The following are given as examples: iodine deficiency, hepatoma, gas bubble disease, furunculosis, corynebacterial kidney diseases, and diseases caused by gliding bacteria. The article is concluded with remarks on disease prevention in Atlantic salmon and the significance of an epizootiological approach to fish culture. (Author). 000741.

000240

Srivastava, G. C., Srivastava, R. C.

1978. A note on the potential applicability of malachite green oxalate in combating fish-mycoses. Mycopathologia 64(3):169-171. (Dep. Botany, St. Andrew's Coll. Gorakhpur, India.).

In the present investigations the potential fungicidal ability of malachite green oxalate has been tested in vitro on four fish-pathogenic isolates of Saprolegniaceae fungi viz. *Saprolegnia ferax* (Gruith) Thuret, *Achlya flagellata* Coker, *Aphanomyces laevis* De Bary and *Isoachlya anisosporea* var. *indica* Saxena and Bhargava and the lowest concentration having fungicidal ability has been found to be 0.5 ppm. Tolerance tests have also been conducted using *Puntius sophore*, *Colisallia*, *Anabas testudineus* and *Catla catla* as test fishes. Also the applicability of the lowest fungici-

dal concentration of this chemical (i. e. 0.5 ppm) in sustained culturing of the adult individuals of *Catla catla*, as major food fish, against the mycotic infection, has been tested. (Authors). 000646

000241

Srivastava, R. C.

1978. Host range of *Achlya orion* Coker and Couch on certain freshwater fishes. *Mycopathologia* 64(1):49-51. (Dep. Botany, St. Andrew's Coll. Gorakhpur, India.).

By the present investigations the host range of *Achlya orion* Coker and Couch has been extended to, *Funtius sophore*, *Puntius ticto*, *Puntius conchoni*, *Puntius sarana*, *Chanda ranga*, *Channa marulius*, *Channa punctatus*, *Notopterus notopterus*, *Labeo rohita*, *Colisa lalia* and *Anabas testudineus*; 11 freshwater fishes. (Author). 000648.

000242

Srivastava, R. C.

1979. Aphanomycosis — a new threat to fish population. (Aphanomykose — Eine neue Bedrohung für Fischbestände.) *Mykosen* 22(1):25-30. (Botany Dep. S.M.M.T.P. Coll. Ballia, India.).

An interesting case of fish mycosis caused by a typical gemmae forming isolate of *Aphanomyces* (*Aphanomyces pisci* sp. nov.) is being reported from Indian waters. The present case is quite different from the general term 'Saprolegniasis' in the sense that it causes blackening of the scales and subsequent exfoliation exposing the body flesh of the adult individuals of *Cirrhinus mrigala* Ham after which the fishes usually die. Based on these facts the disease has been termed as 'Aphanomycosis'. This disease was found to be responsible for the mortality of about 90 percent of fishes in the waters of government fish-ponds, Khukhundu, Deoria (UP) India, during 1974. (Author). 000647.

000243

Stankiewicz, E. B.

1979. Fish culture in water heated by thermal effluents. (Choroby ryb w hodowli sadzowej w wodach podgrzanych.) *Gospodarka rybna* 31(9):11-13. (Szczecin, Poland.).

Water below a power plant on the lower Oder River in Poland is heated to 15°C in winter and to

30°C in summer. Oxygen content of the water is as much as 8 ppm. The water is used for culture of rainbow trout in winter and for carp in summer. The author discusses the relationships between fish, the environment and pathogens as defined by Snieszko in 1976 in the equation  $D = H P S^2$

Bacteriological examination of the river water in February 1978 indicated a population of 7400 bacteria per mL. *Cytophagales* were among the bacteria, and caused numerous outbreaks of columnaris disease. Columnaris disease responded to treatment with a Polish mixed drug supplement and with chloramphenicol. Fingerling carp weighing 3-7 g and wintering in the heated canal water were an exception.

Spring viremia of carp occurred only in carp that were stressed by a sudden temperature change of 16°C that resulted from a malfunction in the power plant.

Gas bubble disease was observed in winter in areas that were free of ice as a result of the heated effluents.

Flukes (*Diplostomum*) that resulted in loss of eyes were more common in winter than in summer, probably because of concentrations of definitive avian hosts on the open water. Seasonal occurrences of various diseases tend to disappear in heated waters. (S. F. Snieszko). 000704. (Paper in Polish)

000244

Stickney, R. R., White, D. B.

1974. Lymphocystis in tank-cultured flounder. *Aquaculture* 4:307-308. (Skidaway Inst. Oceanogr. Savannah, Ga. 30304.).

A case report of a 1972 outbreak in a flow-through system. Sand filtration and UV irradiation were added and the disease did not occur the following year. (Ken Wolf). 000658.

000245

Sugiyama, T., Ueki, N.

1978. On fish diseases in Okayama prefecture (1977). *Bull. Fish. Exp. Stn. Okayama Pref.* 52(5):228-231. (Fish. Exp. Stn. Okayama Pref. Kashino, Ushimado, Okayama, Japan.).

000748. (Paper in Japanese)

000246

Thakur, N. K., Nasar, S. A. K.

1977. On the occurrence of lymphocystis in *Anabas testudineus* (Bloch). Curr. Sci. 46(5):150-151. (Cent. Inland Fish. Res. Inst. Laheriasarai 846 001, Darbhanga, Bihar, India.).

A case report, possibly the first, from India. (Ken Wolf). 000657.

000247

Tuffery, G., Dehand, G.

1979. Experimental study of the conditions for isolation of the agent of carp erythrodermatitis. (Etude experimentale des conditions d'isolement de l'agent de l'erythrodermatite de la carpe (*Cyprinus carpio*)). Bull. Fr. Piscic. 275:83-89. (Lab. Cent. Rech. Vet. 22, Rue Pierre Curie, B.P. no 67, 94704 Maisons Alfort Cedex, France.).

Experimental batches of carps have been inoculated with a C.E. strain, for the disease record and to try germ isolation from lesions and kidney of fishes.

Fish dead bodies have been stored under different temperature conditions (4, 10, 20°C), and during several time periods (24, 48, 96 h), to ensure germ conservation.

Never has C.E. bacteria been isolated from dead fishes more than 10 days after inoculation, always before ulcers appearance.

Fish kidney is always free from C.E. bacteria.

Germ conservation in dead bodies is very limited, even under the best cold conditions and the most limited storing time.

Bacteriological techniques are not suitable for systematic detection of C.E. and there is a need of specific antibodies display methods.

C.E. dead carps are not a source of infection for fish pond populations. (Authors). 000701. (Paper in French)

000248

Wyatt, E. J.

1979. *Facieplatycauda pratti* gen. n. sp. n. and two new species of *Myxobolus* (Myxosporida). J. Protozool. 26(1):47-51. (Dep. Biol. Hamline Univ. St. Paul, Minn. 55104.).

*Facieplatycauda pratti* gen. n. sp. n. and *Myxobolus kozloffii* sp. n. from the Klamath Lake sucker, *Catostomus luxatus* (Cope), are described. The new genus is placed in the family Myxobolidae between *Henneguya* and *Myxobolus*. (Author). 000673.

000249

Yamashita, K.

1979. Damages of red seabream (*Pagulus major*) larvae caused by the parasitism of larval digenetic trematode. Fish Pathol. 14(1):39-42. (Nagasaki Pref. Inst. Fish. Matsugae-cho, Nagasaki, Japan.).

A large amount of red seabream *Pagulus major* larvae, 8.0-11.0 mm in total length, was killed by the parasitism of larval trematode during a course of experimental culture in large scale.

Many young larvae trematode were found in the alimentary canal, and a few in the urinary bladder, ureter and renal tubule of the diseased larvae of red seabream.

The infection was presumably caused by the active feeding of red seabream larvae on the larval trematode liberated from their first intermediate host, top shell (*Batillus cornutus*). (Author). 000706. (Paper in Japanese)

# TOXICOLOGY

000250

Armstrong, F. A. J., Scott, D. P.

1979. Decrease in mercury content of fishes in Ball Lake, Ontario, since imposition of controls on mercury discharges. *J. Fish. Res. Board Can.* 36(6):670-672. (Dep. Fish. Oceans, Freshw. Inst. Winnipeg, Man. R3T 2N6, Canada.).

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Buckley, J. A., Whitmore, C. M., Liming, B. D.

1979. Effects of prolonged exposure to ammonia on the blood and liver glycogen of coho salmon (*Oncorhynchus kisutch*). *Comp. Biochem. Physiol.* 63C:297-303. (Municipality Metrop. Seattle, Water Qual. Div. Lab. 821 Second Ave. Seattle, Wash. 98104.).

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Johansson-Sjoberg, M. L., Larsson, A.

1979. Effects of inorganic lead on delta-amino-levalulinic acid dehydratase activity and hematological variables in the rainbow trout, *Salmo gairdnerii*. *Arch. Environ. Contam. Toxicol.* 8:419-431. (Dep. Zoophysiol. Univ. Goteborg, Fack, S-400 33 Goteborg, Sweden.).

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Kurelec, B., Matijasevic, Z., Rijavec, M., Alacevic, M., Britvic, S., Muller, W. E. G., Zahn, R. K.

1979. Induction of benzo(a)pyrene monooxygenase in fish and the salmonella test as a tool for detecting mutagenic/ carcinogenic xenobiotics in the aquatic environment. *Bull. Environ. Contam. Toxicol.* 21(6):799-807. (Lab. Mar.

Mol. Biol. Cent. Mar. Res. Rudjer Boskovic Inst. 41001 Zagreb, P. O. B. 1016, Yugoslavia.).

000665.

000254

Liden, L. H., Burton, D. T., Margrey, S. T., Block, R. M., Rhoderick, J. C.

1977. Effects of chlorinated and bromochlorinated power plant condenser cooling waters on survival and blood pH of Atlantic menhaden (*Brevoortia tyrannus*) and spot (*Leiostomus xanthurus*). *ASB (Assoc. Southeast. Biol.) Bull.* 24(2):66. (Acad. Nat. Sci. Philadelphia, Benedict Estuarine Res. Lab. 19th and Parkway, Philadelphia, Penn. 19103.).

000680.

000255

Noshkin, V. E., Wong, K. M., Eagle, R. J.

1979. Plutonium concentrations in fish and seawater from Kwajalein Atoll. *Health Phys.* 37:549-556. (Environ. Sci. Div. Lawrence Livermore Lab. Livermore, Calif. 94550.).

000684.

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Ozoh, P. T. E., Jacobson, C. O.

1979. Embryotoxicity and hatchability in *Cichlasoma nigrofasciatum* (Guenther) eggs and larvae briefly exposed to low concentrations of zinc and copper ions. *Bull. Environ. Contam. Toxicol.* 21(6):782-786. (Inst. Zool. Upsala Univ. Box 561, S-751 22 Upsala, Sweden.).

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Pfeifer, K. F., Weber, L. J.

1980. The effect of carbon tetrachloride treatment on urine flow rate of the rainbow trout, *Salmo gairdneri*. Toxicol. Appl. Pharmacol. 52:347-350. (Mar. Sci. Cent. Oregon State Univ. Newport, Ore. 97365.).

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Randall, W. F., Dennis, W. H., Warner, M. C.

1979. Acute toxicity of dechlorinated DDT, chlordane and lindane to bluegill (*Lepomis macrochirus*) and *Daphnia magna*. Bull. Environ. Contam. Toxicol. 21(6):849-854. (U.S. Army Med. Bioeng. Res. Dev. Lab. Fort Detrick, Frederick, Md. 21701.).

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Schulz, D.

1973. Contribution to the general pathology of endocardial reactions: toxic endocardial changes in lower vertebrates (carp). (Beitrag zur allgemeinen Pathologie der Endokardreaktionen. Toxisch bedingte Endokardveränderungen bei niederen Wirbeltieren (Karpfen).) Virchows Arch. Abt. A Pathol. Anat. 358:273-280. (Max von Pettenkofer-Inst. des Bundesgesundheitsamtes, D-1000 Berlin 33, Unter den Eichen 82-84, Fed. Rep. Germany.).

000682.

000260

Sigmon, C.

1979. Oxygen consumption in *Lepomis macrochirus* exposed to 2,4-D or 2,4,5-T. Bull. Environ. Contam. Toxicol. 21(6):826-830. (Zool. Dep. Clemson Univ. Clemson, S. C. 29631.).

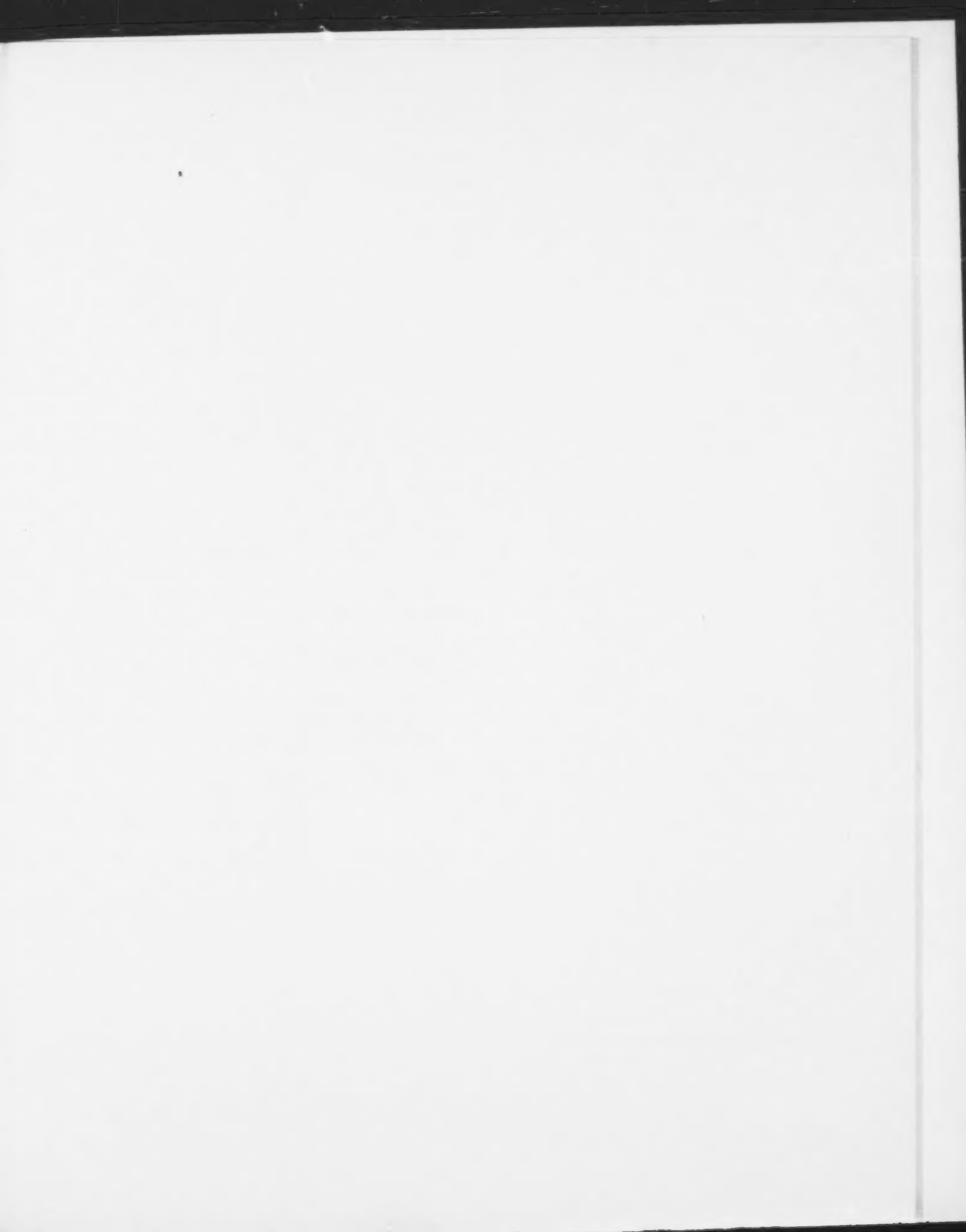
000667.

000261

Srivastava, A. K., Mishra, S.

1979. Blood dyscrasia in a teleost, *Colisa fasciatus* after acute exposure to sublethal concentrations of lead. J. Fish Biol. 14(2):199-203. (Dep. Zool. Univ. Gorakhpur, Gorakhpur 273 001, U. P. India.).

000670.





### INFORMATION FOR AUTHORS

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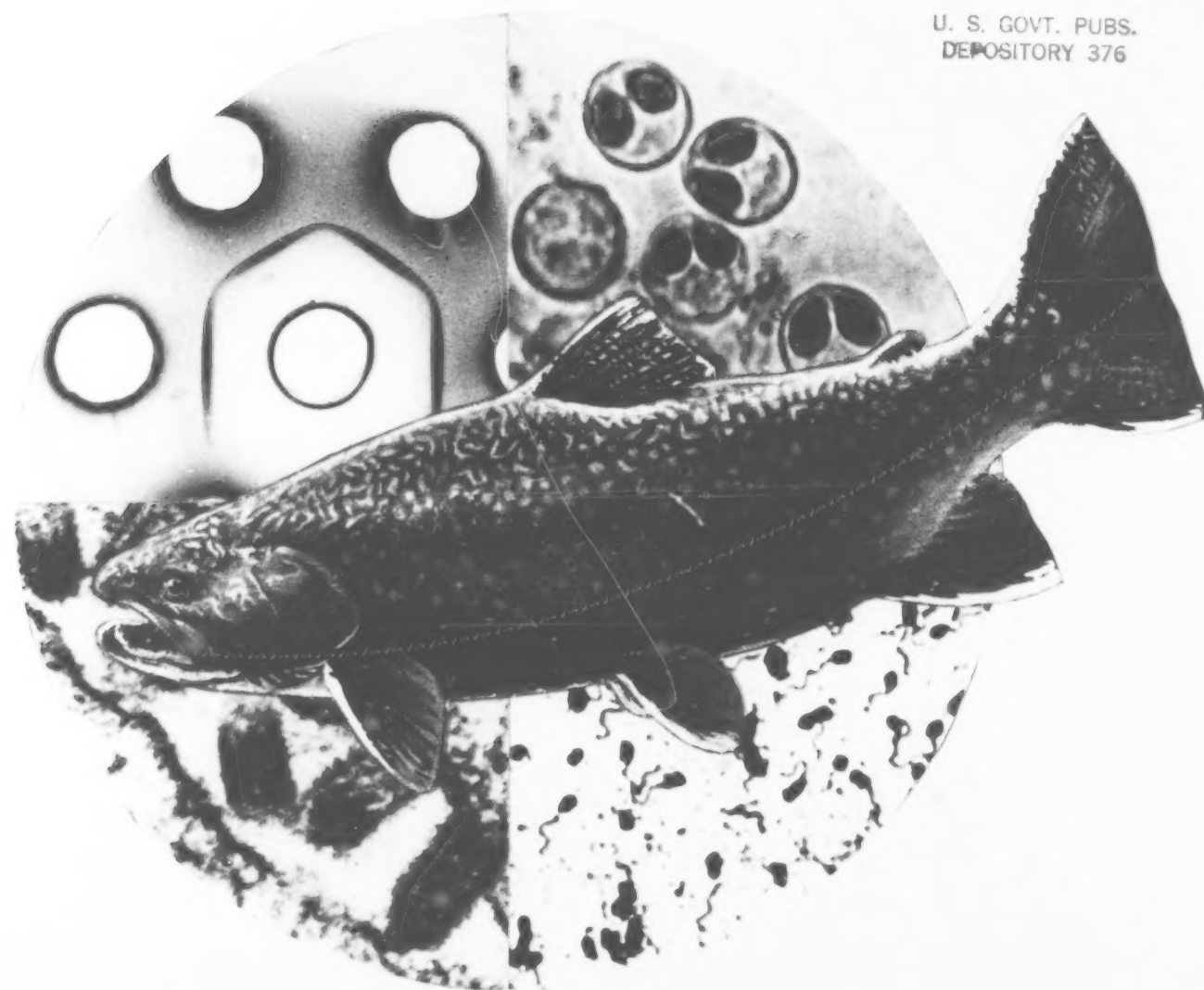
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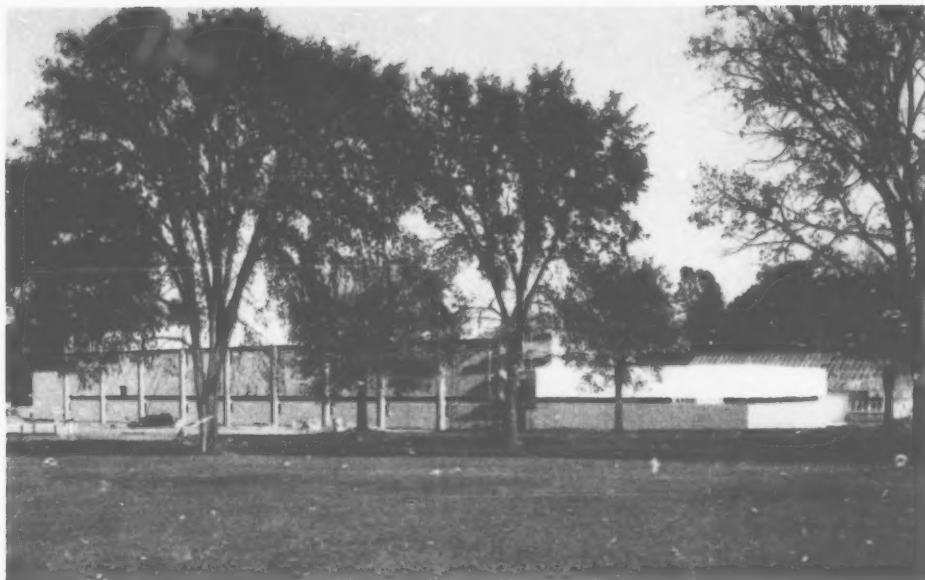
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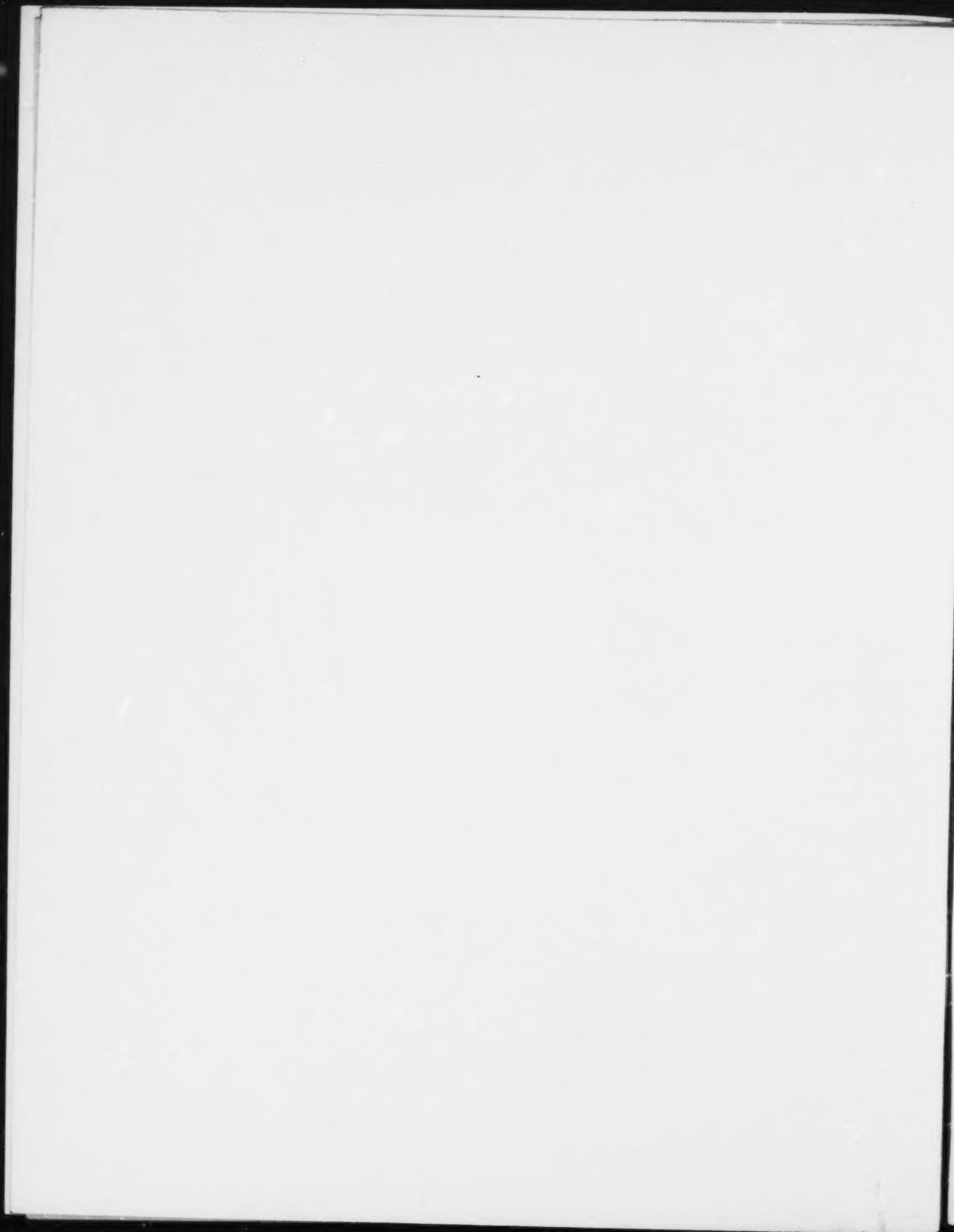
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## REPORTS

### Fish Parasites: the Cryopreservation of *Ichthyophthirius multifiliis*

Catherine R. Beeler  
Kansas State University  
Division of Biology  
Manhattan, Kansas 66506

*Ichthyophthirius multifiliis* is an obligate parasite; accordingly, maintenance of laboratory stocks requires a regular supply of susceptible host fish. However, fish populations vary in susceptibility to and yields of *I. multifiliis*, and periods of reduced yield or even total loss of the parasite are not uncommon. No fish parasite has been successfully cultured in vitro. However, low temperature storage, or cryopreservation, offers a dependable alternative for providing standardized stocks of *I. multifiliis*.

Channel catfish (*Ictalurus punctatus*) were exposed to *I. multifiliis* obtained from other catfish or tropical fish. Trophozoites and cysts were harvested according to the method of LeValley (1979), concentrated to about  $10^4$  cells/ml, and cooled to 4°C on ice. Dimethyl sulfoxide (DMSO) was diluted to a 40% concentration using 20% aqueous glucose as diluent then cooled on ice. The cells were prepared for preservation by adding 0.25 ml of the dilute DMSO and 0.75 ml fetal bovine serum to 1 ml of the cells in a glass screw cap tube. The final DMSO concentration was 5.0%. The tubes were held at -5°C for 5 min, then seeded by touching the solution with an ice crystal to initiate extracellular freezing (Leibo and Mazur 1978). After 10 min equilibration, the tubes were transferred to a controlled cooling apparatus (Beeler 1980). The apparatus was set at 23.75 "Hg (60.32 cm Hg) vacuum, temperature -5°C, with 600 ml ethanol as the cooling medium. The tubes were cooled at a rate of -1°C per min to -45°C, then plunged into liquid nitrogen for storage.

Two weeks later the cells were thawed in an ice slush at a rate of approximately 10°C per min. Cells were then diluted with 6 ml cold 20% glucose solution and 2 ml cold fetal bovine serum and held in ice for 2 h. After washing, the cells were left overnight in filtered fish tank water in preference to distilled or dechlorinated tap water. Tomites were observed the following morning. Some samples were tested with a fluorescein diacetate viability assay (Rotman and Papermaster 1966; Frim and Mazur 1980) immediately upon thawing. Both trophozoites and cysts had 60-65% survival rates.

Trophozoites and cysts retained the ability to divide after having been frozen and thawed. Invasiveness of the tomites however, has yet to be determined, and that aspect is currently under investigation.

#### REFERENCES

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- Frim, J., and P. Mazur. 1980. Approaches to the preservation of human granulocytes by freezing. *Cryobiology* 17:282-286.
- Leibo, S. P., and P. Mazur. 1978. Methods for the preservation of mammalian embryos by freezing. Pages 179-201 in J. C. Daniels, Jr., ed. *Methods in mammalian reproduction*. Academic Press, New York.
- LeValley, M. 1979. Treatment of Ichthyophthiriasis in channel catfish with a triiodinated resin and free iodine. MS Thesis. Kansas State University, Manhattan. 36 pages.
- Rotman, B., and B. W. Papermaster. 1966. Membrane properties of living mammalian cells as studied by enzymatic hydrolysis of fluorogenic esters. *Proc. Natl. Acad. Sci. USA* 55:134-141.

Rijkers, Ger T. 1980. The immune system of cyprinid fish. PUDOC Publishers, Wageningen, The Netherlands. 176 pages.

This new book on immunology of fishes was written in part to fulfill the requirements for the doctoral degree of Ger T. Rijkers, Department of Experimental Animal Morphology and Cell Biology, Agricultural University, Wageningen, The Netherlands.

In the first chapter, the author details the comparative anatomy of cells and organs involved in the immune response; and the next six chapters review non-lymphoid mechanisms of defense, immunoglobulin structure and function, humoral immunity, cellular immunity, lymphocyte heterogeneity, and factors affecting the immune response. There are excellent tables explaining the phylogeny of the immune systems in fishes and an extensive bibliography enabling the reader to follow the development of the science of immunology of fishes.

In earlier literature there has been some controversy concerning the existence and interactions of subpopulations of lymphocytes in fish. Several researchers are actively working to demonstrate antibody production by B-cells, but the definition of T-cells is less certain. Also, problems arise as to whether some species of

fish have only one class and molecular size of immunoglobulin, which would be a departure from the immune system in higher animals. Dr. Rijkers has reviewed these problems and presents a clear picture and direct comparison of the immune responses of fishes and mammals. Detailed scientific discussions necessary in the dissertation may be complex for the fisheries student. The complexity is reduced by the author's method of inserting highlighted, comprehensible summary sentences at the end of each section. Thus, the nonspecialist has an overview of experiments.

The book includes reproductions of six of the authors published papers; four concerning the development of cellular and humoral immune responses in carp, methods of detection, and immunization regimen studies; two showing the immunosuppressive effects of feeding high levels of oxytetracycline to carp. Another unusual feature is a clever 21-page section *Immunologie van de Karper* that has original sketches explaining the initiation and production of the cellular and humoral immune responses.

The major portion of the book is written in English but the last section is in Dutch.

--D. P. Anderson

Warren, J. W. 1980. Diseases of hatchery fish. U.S. Fish and Wildlife Service, Fish Dis. Manual. 91 pp.

The manual is a revision of the first edition (1971), and it contains sections on the following diseases: bacterial (30 p.), parasitic (21 p.), viral (11 p.), miscellaneous (4 p.); treatment methods (8 p.), tables and references (7 p.). Diseases of salmonids and catfish and control of diseases in fish hatcheries and pondfish farms are discussed.

Descriptions of bacterial and viral diseases include introductory discussions on taxonomy followed by symptomatology, diagnosis, epizootiology, and control. The section on parasitic diseases contains a key to the major groups of parasites and their usual target tissues or organs. Descriptions of the resulting diseases, morphological identification of parasites, schematic drawings of parasites, and control methods follow.

The section on miscellaneous diseases covers cataracts, gas bubble disease, ammonia intoxication, oxygen deficiency, sunburn, soreback, coagulated yolk disease, and soft egg disease. Discussions of treatments are quite detailed and include information on the use of drugs as food additives, external treatments, and disinfection of eggs. Tables are useful in calculating dosages, and there is detailed information on conversion and dilution factors. References consist primarily of textbooks and symposia.

I consider the information correct and lucidly presented. However, if one accepts the taxonomy presented in the 8th edition of Bergey's Manual, the term "myxobacteria" is incorrect. The difference in bacterial taxonomy presents difficulty in discussions of the etiology of bacterial gill, peduncle and coldwater diseases.

Formalin dilution factors of 1667, 250, and 167 ppm are given. The concentrations are correct, but it would be simpler to say that formalin should be used at dilutions of 1:600, 1:4000, and 1:6000. These figures should be added in parentheses. The use of Hyamine and Roccal is recommended at a concentration of 2 ppm. However, quaternary ammonium compounds are usually purchased in diluted form; therefore, the dosage should be multiplied by the dilution factor of the commercial product. The manual recommends sulfamerthiolate for egg disinfection, but the drug is no longer available. Merthiolate is a related compound that is available and can be used. Today, iodophors such as Betadine are preferred for disinfecting eggs. In using iodophors, the recommended dosage (50 to 150 ppm) is based on the pure elemental iodine in the product. In summary, I wish to say that this is a very informative and valuable text for hatchery personnel.

--S. F. Snieszko



## ITEM OF INTEREST

### GRADUATE STUDIES IN FISH DISEASES

A rare opportunity exists for funded graduate work in the field of fish diseases, leading to a Masters degree or possibly a Ph.D. In addition to research training, the successful candidate will have the opportunity of gaining experience in the diagnosis of fish diseases by sharing in the routine diagnostic service and contract-research activities of the Fish Pathology Laboratory, that are orientated towards both aquaculture and environmental problems. Preference will be given to candidates with some background in pathology. Experience with fish, while desirable, is not essential.

Applicants must meet the academic standards for admission to the Faculty of Graduate Studies, University of Guelph. Requests for further information should be directed to the Chairman, Department of Pathology, Ontario Veterinary College, Guelph, Ontario, Canada N1G 2W1.

## LIBRARY ACCESSIONS

000262

Achenbach, H., Kohl, W., Reichenbach, H.

1978. The flexirubin-type pigments — a novel class of natural pigments from gliding bacteria. *Rev. Latinoam. Quim.* 9:111-124. (Chem. Lab. Univ. Freiburg, 78 Freiburg, Fed. Rep. Germany.).

The pigments in gliding bacteria were considered to be carotenoids until the isolation and structure elucidation of the main pigment from *Flexibacter elegans*, which we named Flexirubin. Flexirubin belongs to a new class of natural products. This paper reports the isolation procedure, structure determination, total synthesis and biosynthesis of flexirubin and of some 20 more pigments from gliding bacteria of the *Cytophaga/Flexibacter* group. (Authors). 000957.

000263

Ahmed, A. T. A., Egusa, S.

1980. Dermal fibrosarcoma in goldfish *Carassius auratus* (L.). *J. Fish Dis.* 3(3):249-254. (Dep. Zool. Univ. Dacca, Dacca-2, Bangladesh.).

Host fish among three ponds in Bangladesh showed a 7 per cent incidence of single or multiple neoplasms of undetermined etiology. The fish originated in Japan, but recent reports of dermal tumors among the Japanese farms are lacking. The tumors were external on the body, the opercula, on or near the dorsal fin, but not on ventral surfaces. Neither encapsulation nor metastasis occurred, but larger growths showed some invasiveness. Mitoses were not numerous, but a few multinucleated giant cells were found. Carp and tilapia in the same three ponds were without tumors. Macro and microphotographs illustrate text descriptions. (Ken Wolf). 000786.

000264

Ahmed, A. T. A., Sanaullah, M.

1979. Pathological observation of the intestinal lesions induced by caryophyllid cestodes in *Clarias batrachus* (Linnaeus) (Siluriformes: Clari-

dae). *Fish Pathol.* 14(1):1-7. (Dep. Zool. Univ. Dacca, Dacca-2, Bangladesh.).

The comparative histopathology as related to modes of attachment and scolex morphology, gross anatomy, host response and effects of the three caryophyllid cestodes *Djombangia penetrans*, *Lytocestus indicus* and *L. parvulus* was studied. Among them *D. penetrans* was found to be most pathogenic and elicited pronounced host reaction in the form of nodules and complete penetration of the intestine followed by *L. indicus* which caused shallow ulcers and mechanical obstruction, and *L. parvulus* caused denudation of the host intestinal tissues. Distribution of the cestodes in the intestine, multiple infections and niche widths as related to scolex morphology, modes of attachment as well as habitats are discussed. Photomicrographs of the species *in situ*, and of histopathology supplement the observations. (Authors). 000914.

000265

Amend, D. F., Antipa, R., Kerstetter, T. H.

1980. Increase in ocean survival of freely migrating steelheads vaccinated against *Vibrio anguillarum*. *Trans. Am. Fish. Soc.* 109(3):287-289. (Tavolek Inc. 2779 152nd Ave. Northeast, Redmond, Wash. 98052.).

Steelheads (*Salmo gairdneri*) were vaccinated as juveniles against two serotypes of *Vibrio anguillarum*, marked, and allowed to migrate freely to the sea. A statistically significant ( $P < 0.01$ ) 19.3% increase in return rate of adults to the hatchery occurred among the vaccinated group compared to the nonvaccinated control group. No difference between groups was found in the size or sex ratio of returning fish. (Authors). 000849.

000266

Anderson, D. P., Roberson, B. S., Dixon, O. W.

1979. Induction of antibody-producing cells in rainbow trout, *Salmo gairdneri* Richardson, by flush exposure. *J. Fish Biol.* 15(3):317-322. (U.S. Fish Wildl. Serv. Natl. Fish Health Res. Lab. Route 3, Box 50, Kearneysville, W. Va. 25430.).

Small batches (5 fish) of rainbow trout 300-400 g were exposed to O-antigens from *Yersinia ruckeri* and *Aeromonas salmonicida*. Trout were either immersed for 2 min in water containing 5, 50, or 100  $\mu$ g of *Y. ruckeri* antigen or this antigen was added to the tank water at a rate of 5  $\mu$ g per ml. In the latter case, the water flow was resumed after 2 min of static exposure, and antigen was gradually washed out.

Trout exposed to *A. salmonicida* antigen were immunized by IP injection (50, 100, 500  $\mu$ g per fish) or immersion (50, 100, 500  $\mu$ g per ml). Unexposed controls were used.

In the second test with *A. salmonicida*, trout were injected IP with 500  $\mu$ g antigen per fish, immersed for 2 min in water containing 500  $\mu$ g of antigen per ml, and by addition of 500  $\mu$ g antigen per ml of water in tank and gradually flushing it out.

Two weeks after exposure, spleens from individual fish were assayed for antibody producing cells among spleen lymphocytes. Findings were expressed as numbers of antibody producing cells per 10<sup>6</sup> lymphocytes.

All methods of immunization resulted in the appearance of some antibody producing cells. The antigen from *Y. ruckeri* was many times more active than that from *A. salmonicida*. (S. F. Snieszko). 000801.

000267

Antipa, R., Gould, R., Amend, D. F.

1980. *Vibrio anguillarum* vaccination of sockeye salmon *Oncorhynchus nerka* (Walbaum) by direct and hyperosmotic immersion. J. Fish Dis. 3(2):161-165. (Tavolek, Inc. 2779 152nd Ave. N.E. Redmond, Wash. 98052.).

Hyperosmotic immersion (HI) and direct immersion (DI) were compared in trials with fingerlings. Both methods of immunization gave high levels of protection when undiluted bacterin was used, but the HI method was the better when antigen was diluted to 10<sup>-3</sup> and 10<sup>-4</sup>. Both methods provided solid protection at 80 days with undiluted antigen or with dilutions of 10<sup>-3</sup>, but protection from diluted material had begun to decline at 120 days. Booster vaccination was judged not warranted. The authors concluded that the HI method was slightly better when highly diluted bacterin was used but that it stressed the fish more than the DI method. (Ken Wolf). 000760.

000268

Aquaculture Team of the Oceanology Center of the Pacific, AQUACOP.

1979. About the concept of crowding disease and sanitary lot in modern intensive aquaculture: a short note. Proc. World Maricult. Soc. 10:551-553. (Cent. Oceanolog. Pacifique, CNEXO-COP, B.P. 7004, Taravao, Tahiti, French Polynesia.).

Most of the diseases that occurred in modern intensive aquaculture are due to opportunistic pathogens and can be considered as crowding diseases. The application of the sanitary lot technique would greatly reduce the spread of such diseases. (Authors). 000864.

000269

Arthur, J. R., Arai, H. P.

1980. Studies on the parasites of Pacific herring (*Clupea harengus pallasii* Valenciennes): survey results. Can. J. Zool. 58(1):64-70. (Dep. Fish Oceans, Fish. Mar. Serv. Resour. Serv. Branch, Pacific Biol. Stn. Nanaimo, B. C. Canada V9R 5K6.).

The results of a survey of the parasite fauna of Pacific herring (*Clupea harengus pallasii* Valenciennes) conducted during the years 1975 to 1977 are presented. Thirty-two species (three myxosporidia, three protozoa, two monogenea, nine digenea, three cestodea, six nematoda, four acanthocephala, and two copepoda) are reported from examination of 175 juvenile and 594 adult herring collected from the waters off California, Oregon, Washington, British Columbia, and Alaska. Among those parasites for which specific identifications could be made are five species previously unreported from the genus *Clupea* (metacercariae of *Proserorhynchoides basargini* and *Galactosomum phalacrocoracis*; plerocercoids of *Nybelinia surmenicola*; juvenile *Corynosoma villosum*; and *Rhadinorhynchus trachuri*; and three species not previously reported from North American waters (*Ortholinea orientalis*; *Gyrodactyloides petruschewskii*; and *Gyrodactylus harengi*). (Authors). 000811.

000270

Becker, C. D.

1980. Haematozoa from resident and anadromous fishes of the central Columbia River: a survey. Can. J. Zool. 58(3):356-362. (Ecol. Sci. Dep. Pacific Northwest Lab. Battelle Memorial Inst. Richland, Wash. 99352.).

Fish were surveyed for hematozoa from the central Columbia River, state of Washington, U.S.A. from 1968 to 1978. The 840 individuals examined represented 12 families and 34 species. Most infections occurred in sucker (*Catostomidae*) and sculpin (*Cottidae*). Nine species of fish were parasitized by one or two species of hematozoa. Intensities of all detected parasitemias were low, indicating no symptomatic damage to infected hosts.

*Trypanoplasma salmositica* (Katz 1951) was recorded for the first time in white sturgeon (*Acipenser transmontanus*), largescale sucker (*Catostomus macrocheilus*), bridgelip sucker (*C. columbianus*), northern squawfish (*Ptychocheilus oregonensis*), and sculpin of the *Cottus confusus/bairdi* complex; it was also found again in prickly (*C. asper*) and piute (*C. beldingi*) sculpin. *Haemogregarina catostomi* Becker 1962 occurred in about 23% each of largescale and bridgelip sucker. Other hematozoa encountered were a hemogregarine in 1 of 23 steelhead (*Salmo gairdneri*), a hemogregarine in 3 of 92 sculpin (*Cottus* spp.), and a dactylosome in 1 of 10 American shad (*Alosa sapidissima*).

The sequence of *Haemogregarina catostomi* occurrence in erythrocytes was the following: young gametocytes in the fall, mature gametocytes in winter, degenerative gametocytes in spring, and absence of infection in summer. The piscicolid leeches *Myzobdella lugubris* Leidy and *Piscicola salmositica* Meyer might transmit hematozoa among fish in the survey area. (Author). 000933

000271

Berka, R., Kujal, B., Lavicky, K.

1980. Sterilization of water for fish-culture purposes (Review). (Sterilizace vody pro rybochovne ucely (prehled).) Bull. VURH Vodnany 16(1):31-36. (Vyzkumny ustav rybarsky a hydrobiologicky, 389 25 Vodnany, Czechoslovakia.).

This paper is not a report of original research; it is a literature review prepared from 14 references. Table 1 presents the coefficient of killing of microorganisms (names not indicated) by various unspecified dosage of ultraviolet light. Table 3 shows the requirements of ultraviolet light in microwatts per second per cm<sup>2</sup> to kill 31 species of bacteria, 5 species of yeasts, 10 species of fungi, bacteriophage of *Edwardsiella coli*, *Paramecium*, an unidentified nematode, and *Chlorella vulgaris*.

Among the 14 references, there are eight in English, two in German, two in Polish, and two in Czechoslovakian.

Illustrations show ultraviolet equipment manufactured by Aquafine Corp. in California. (S. F. Snieszko). 000955. (Paper in Czech.)

000272

Bermudez, D.

1980. Preliminary experiences in the control of fish diseases in warm water aquaculture operations in Venezuela. J. Fish Dis. 3(4):355-357. (Estacion de Piscicultura, Escuela de Agronomia, Univ. Centro-Occidental, Apartado de Correos No 400, Barquisimeto, Edo. Lara, Venezuela.).

A brief description of control measures used to prevent losses due to *Saprolegnia* and Ichthyophthiriasis in warm water husbandry of characin and anostomid fishes. Polyvinylpyrrolidone iodine is used prophylactically to treat traumatized brood stock and eggs (100 ppm I<sub>2</sub>, 5-10 min) prior to incubation. Benzalkonium chloride is used as a general disinfectant for equipment and utensils. A commercial mixture of formalin and malachite green is used as a fungicide and parasiticide. Chemical concentrations are given as dilutions of commercial preparations. (Ken Wolf). 000840

000273

Beverley-Burton, M., Suriano, D. M.

1980. *Cleidodiscus robustus* Mueller, 1934 (Monogenea: Ancyrocephalinae) from *Lepomis gibbosus* L. (Pisces: Centrarchidae) in Ontario, Canada: anatomy and systematic position. Can. J. Zool. 58(4):654-660. (Dep. Zool. Coll. Biol. Sci. Univ. Guelph, Guelph, Ont. Canada N1G 2W1.).

*Cleidodiscus robustus* Mueller, 1934 (Monogenea: Ancyrocephalinae) from the gills of *Lepomis gibbosus* L. (pumpkinseed) in Ontario, Canada, is redescribed with details of the internal anatomy as well as the sclerotized components of the haptor and copulatory complex. A revised generic diagnosis incorporating features of the reproductive system is presented. (Authors). 000890.

000274

Beverley-Burton, M., Suriano, D. M.

1980. *Haploclidius dispar* (Mueller, 1936) and *Pterocleidus acer* (Mueller, 1936) (Monogenea: Ancyrocephalinae) from *Lepomis gibbosus* L. (Pisces: Centrarchidae) in Ontario, Canada: anatomy and systematic position. Can. J.



Zool. 58(4):661-669. (Dep. Zool. Coll. Biol. Sci. Univ. Guelph, Guelph, Ont. Canada N1G 2W1.).

*Haploclleidus dispar* (Mueller, 1936) Mueller, 1937 and *Pterocleidus acer* (Mueller, 1936) Mueller, 1937 (Monogenea: Ancyrocephalinae) from the gills of *Lepomis gibbosus* L. (pumpkinseed) in Ontario, Canada, are redescribed with details of their internal anatomy as well as the sclerotized components of the haptor and copulatory complex. Revised generic diagnoses incorporating features of the reproductive systems are presented. (Authors). 000889.

000275

Bogdanova, E. A.

1976. Characteristics of parasitic fauna and distribution of epidemic diseases in salmon and trout of diversified fisheries of the USSR. (Osobennosti Parazitofauny I Raspostranyeniye Invazyonnykh Bolesnyey U Lososyey I Foreli V Raznotipnykh Khozyastvakh SSSR.) Izv. Gos. Nauchno-Issled. Inst. Ozer. Rechn. Rybn. Khoz. 113:87-92. (Lab. Fish Dis. GOSNIORKH, Leningrad, USSR.).

Data collected during the years 1955-1975 are presented in tabular form and discussed. (Ken Wolf). 000908.

000276

Bouck, G. R., Smith, S. D.

1979. Mortality of experimentally descaled smolts of coho salmon (*Oncorhynchus kisutch*) in fresh and salt water. Trans. Am. Fish. Soc. 108(1):67-69. (U.S. Fish Wildl. Serv. Natl. Fish. Res. Cent. Bldg. 204, Naval Support Activity, Seattle, Wash. 98115.).

Removal of slime from 25% of the body caused no deaths among smolts of coho salmon in fresh water or in seawater (28 ‰). Removal of slime and scales from the same percentage of body area caused no deaths in fresh water, but 75% mortality within 10 days in seawater. The 10-day median tolerance limit was 10% scale removal immediately before the smolts entered seawater. Mortality was highest when the scales were removed from the area of the rib cage. Recovery of smolts in fresh water from a loss of scales that would be lethal in seawater occurred rapidly; 90% of the fish regained tolerance to seawater within 1 day. (Authors). 000943.

000277

Bowser, P. R., Plumb, J. A.

1980. New cell line — fish cell lines: establishment of a line from ovaries of channel catfish. In Vitro 16(5):365-368. (Dep. Fish. Allied Aquacult. Agric. Exp. Stn. Auburn Univ. Auburn, Ala. 36830.).

A cell line was established from the ovaries of a healthy, juvenile channel catfish, *Ictalurus punctatus*. These cells, designated CCO, have been passed 130 times during 3 years. The cells grow well in Eagle's MEM-10 at a temperature of 30°C. Species of origin of the cells was confirmed by a cytotoxic dye exclusion test. The cells were found to be free of bacterial and fungal contamination. A study of chromosome preparations indicated that the karyotype is still in a state of flux. The CCO line replicated channel catfish virus but was refractory to 12 other viruses, 4 from fish, 1 from birds, and 7 from mammals. (Authors). 000894

000278

Bowser, P. R., Plumb, J. A.

1980. Growth rates of a new cell line from channel catfish ovary and channel catfish virus replication at different temperatures. Can. J. Fish. Aquat. Sci. 37(5):871-873. (Dep. Fish. Allied Aquacult. Agric. Exp. Stn. Auburn Univ. Auburn, Ala. 36830.).

Growth rates of a new cell line from the channel catfish, *Ictalurus punctatus*, were determined at temperatures from 10 to 35°C. Growth was more rapid at 35°C with the cells having a population doubling time of 12 h, and cell numbers declined at 10°C. The cells survived frozen storage at -70°C for up to 6 months. Replication of channel catfish virus occurred from 10 to 35°C. Although it was most rapid at 35°C, maximum replication occurred at 30°C. (Authors). 000893

000279

Bowser, P. R., Plumb, J. A.

1980. Channel catfish virus: comparative replication and sensitivity of cell lines from channel catfish ovary and the brown bullhead. J. Wildl. Dis. 16(3):451-454. (Dep. Fish. Allied Aquacult. Agric. Exp. Stn. Auburn Univ. Auburn, Ala. 36830.).

A cell line derived from channel catfish ovary tissue was compared with the brown bullhead (BB) cell line for their respective abilities to replicate



and detect channel catfish virus (CCV). The channel catfish ovary cell line (CCO) produced cytopathic effects (CPE) more rapidly and detected CCV at higher dilutions than did the BB cell line. Production of CCV was more rapid in CCO cells than in BB cells, but the peak titers of the two lines were not significantly different. The CCO cell line was shown to be the more sensitive cell line for CCV research and diagnostics. (Authors). 000886

000280

Brandal, P. O., Egidius, E.

1979. Treatment of salmon lice (*Lepeophtheirus salmonis* Kroyer, 1838) with Neguvon — description of method and equipment. Aquaculture 18(2):183-188. (Inst. Mar. Res. C. Sundts. 37, 5000 Bergen, Norway.).

A bath treatment of 300 ppm Neguvon for 15-60 min effectively eliminates the salmon louse, *Lepeophtheirus salmonis*, from salmonids cultured in sea water. Serious epizootics caused by this parasite have arisen in recent years in Norwegian salmonid farms. The treatment is applied using a special floating pen enabling the same solution to be used for different fish populations. Neguvon residues in treated fish are negligible within 12 days of treatment. Fish should not be harvested within 3 weeks of treatment and the Neguvon should be used under veterinary prescription in Norway. (Authors). 000954

000281

Bucke, D.

1980. A note on acid-alcohol-fast bacteria in mackerel *Scomber scombrus* L. J. Fish Dis. 3(2):173-175. (Minist. Agric. Fish. Food, Fish Dis. Lab. The Nothe, Weymouth, Dorset, DT4 8UB, England.).

A case report of mycobacteriosis in systemic focal granulomata. The lesions are illustrated. (Ken Wolf). 000762.

000282

Burn, P. R.

1980. The parasites of smooth flounder, *Liopsetta putnami* (gill), from the Great Bay estuary, New Hampshire. J. Parasitol. 66(3):532-541. (Osborn Lab. Mar. Sci. New York Aquarium, N.

Y. Zool. Soc. Boardwalk at W. 8th St. Brooklyn, N. Y. 11224.).

Twenty-six species of protozoan and metazoan parasites (including 22 new host records are recorded from smooth flounder (*Liopsetta putnami*) from New Hampshire. Samples were taken monthly over a period of 2.5 years. The assemblage was dominated by nine species of digenetic trematodes, and consisted solely of parasites known to occur in brackish water. All the species varied seasonally in abundance except the hemoflagellate *Cryptobia bullocki* and the trematode *Zoogonus lasius*. The patterns of changes in seasonal abundance were consistent within species from year to year; however, the overall abundance of approximately one-half the parasites changed significantly between years. There were significant differences in parasite abundance between the 0<sup>+</sup>- and 1<sup>+</sup>-year age-groups, some of which are explained on the basis of changes in diet and habitat. The microsporidian *Glugea stephani* was the only species showing evidence of gross pathogenicity, causing lesions in the intestine wall, particularly in the 0<sup>+</sup>- and 1<sup>+</sup>-year age-group hosts. The frequency distributions of metazoa were overdispersed, and that for *Stephanostomum tenue* was fitted to the negative binomial. Truncations of this distribution showed minimal variation in the parameters N, p, and k, indicating minimal pathogenicity by this species. The parasites of flounders in the 0<sup>+</sup>-year age-group were compared from two dissimilar habitats within the estuary. The most prominent differences were the lack of *Cryptocotyle lingua* and *Myxobilatus* sp. at the upper estuarine site. These species serve as biological indicators that fish from the lower estuary did not move upstream during their first summer. There were numerous differences in parasite abundance between the habitats, and the Shannon-Wiener diversity indices for metazoan parasites were significantly different. These data suggest that downstream movement also was limited. The parasite diversity indices apparently were related positively to the diversity of the local free-living communities, and this relationship has implications both for fish health and the possible use of parasite data in evaluating water quality changes. (Author). 000887.

000283

Burrough, R. J.

1978. The population biology of two species of eyefluke, *Diplostomum spathaceum* and *Tylocephalys clavata*, in roach and rudd. J. Fish Biol. 13(1):19-32. (Dep. Biol. Sci. Univ. Exeter, England.).

Infections of roach (*Rutilus rutilus*), and rudd (*Scardinius erythrophthalmus*), by the eyeflukes

*Diplostomum spathaceum* and *Tylodelphys clavata* were studied in a lake over a 3 year period. *Tylodelphys clavata* first appeared at the beginning of the study. Roach were heavily infected by both parasites, whereas the rudd contained very few specimens of either species. A small number of roach-rudd hybrids were also examined, and appeared to have a susceptibility intermediate between the parental types.

Levels of *T. clavata* in roach increased throughout the study. This parasite had a life span of a year or less in the fish, and was continuously lost from the population. This loss was balanced by a minor infection period in April-May and a major one extending from August until January. The fish continued to accumulate infections until they reached a size of about 130 mm, but thereafter intensity fluctuated about the level reached.

*Diplostomum spathaceum* infections similarly increased throughout the period of study, and there was a suggestion of a wave of infection in the spring. This parasite has a much longer life span, and levels of infection increased with fish size, only falling in the largest, and therefore oldest, hosts.

The major changes in the parasite populations in the roach were reflected, to a lesser extent, in the rudd. Both species were over-dispersed, but the data from roach was too heterogeneous to fit to any theoretical models, whereas that from the rudd was found to conform to a negative binomial distribution. (Author). 000936.

000284

Carvajal, J., Cattán, P. E., Castillo, C., Schatte, P.

1979. Larval anisakids and other helminths in the hake, *Merluccius gayi* (Guichenot) from Chile. J. Fish Biol. 15(6):671-677. (Lab. Zool. Inst. Ciencias Biol. Univ. Católica Chile, Casilla 114-D, Santiago, Chile.).

One hundred and twenty hake *Merluccius gayi* caught off central Chile were examined for helminth parasites. Sixty hake were kept in ice from the catch of a trawler were examined upon arrival at port, while the other 60 hake were dissected on board immediately after collection. Ninety one per cent of hake were infected with one or more species of the following helminths: trypanorhynch plerocerci of *Grillotia dollfusi* Carvajal, 1971; adult worms of the genus *Cleistobothrium*; larval nematodes of the genera *Anisakis* and *Phocanema*; 86 per cent of the total were infected with *Anisakis* sp. and 42.5 per cent with *Phocanema* sp. Infection with larval nematodes increased with length

of the fish and there was a greater incidence of infection among the females. There was a greater frequency of occurrence of the parasites in the viscera than in the musculature. (Authors). 000791.

000285

Castric, J., de Kinkelin, P.

1980. Occurrence of viral hemorrhagic septicemia in rainbow trout *Salmo gairdneri* Richardson reared in sea-water. J. Fish Dis. 3(1):21-27. (Lab. Natl. Pathol. Anim. Aquat. Brest, France.).

Viral hemorrhagic septicemia (VHS) is reported for the first time in sea-water cultured rainbow trout. Heavy mortalities with typical signs and lesions occurred about 1 month after the trout were transferred from fresh to sea-water. A VHS virus (serotype 1) was isolated from the diseased fish. The mortalities were caused only by the VHS virus and 80 days post transfer of trout to sea-water the mortalities reached 85% of the initial population.

The disease was experimentally transmitted to rainbow trout, both in sea-water and freshwater, either by immersing the fish in contaminated water containing  $3.10^4$  pfu per ml of virus or by intramuscular injection of various doses of VHS ( $7.10^1$ ,  $7.10^4$  or  $7.10^6$  pfu per fish). Death occurred in all infected groups and started earlier in sea-water. Typical signs of VHS were observed in moribund fish. Viral multiplication was demonstrated to have occurred in fish organs. (Authors). 000927.

000286

Ching, H. L.

1979. The life cycle of *Podocotyle enophrysi* Park, 1937 (Trematoda: Opecoelidae). Can. J. Zool. 57(6):1341-1344. (Dep. Zool. Univ. British Columbia, Vancouver, B.C. Canada V6T 1W5.).

Cotyllocercous cercariae developing in sporocysts in the snail, *Lacuna marmorata* Dall, were used to infect amphipods. *Hyale plumulosa* Stimpson. The infected amphipods were then fed to sculpins, *Oligocottus maculosus* Girard, from which 25 trematodes were recovered 6-45 days later. Development of the worms to adults was followed with worms becoming ovigerous after 25 days; they were identified as *Podocotyle enophrysi*. Descriptions of the larval stages are similar to that of *Podocotyle*

*atomon* (Rudolphi, 1802) Odhner, 1905. (Author). 000938.

000287

Cone, D. K. Miller, J. D., Austin, W. K.

1980. The pathology of saddleback disease of underyearling Atlantic salmon (*Salmo salar*). Can. J. Zool. 58(7):1283-1287. (Dep. Biol. Univ. New Brunswick, Fredericton, N.B. Canada E3B 5A3.).

This study describes the pathology of saddleback disease of underyearling Atlantic salmon (*Salmo salar*) cultured at the Mactaquac Fish Hatchery near Fredericton, New Brunswick. A gram-negative, flexible, bacterium had a constant association with the characteristic lesion. It is thought that the bacteria enter the dorsal fin and then spread into the surrounding dermis by moving through the connective tissue and collagen layers. This causes sloughing of the overlying epidermis and some scales, and results in a symmetrical band of discoloration on the flanks of the body on either side of the dorsal fin. Invasion of the underlying epimysium and perimysium leads the bacteria deep into the dorsal fin levators and the epaxial muscles on either side of the dorsal fin. Evidence suggests the bacteria can enter muscle cells and destroy the cell from within. The bacterium was not found in any other tissue. (Authors). 000892.

000288

Cooper, C. L., Jilek, R., Crites, J. L.

1979. An indication of change in *Ligula intestinalis* (Linn.) occurrence in spottail shiners, *Notropis hudsonius* (Clinton), from western Lake Erie, 1929-1977. Can. J. Zool. 57(9):1829-1830. (Cent. Lake Erie Res. Dep. Zool. Ohio State Univ. Columbus, Ohio 43210.).

Larval tapeworms, *Ligula intestinalis*, were found in the body cavities of only 14 of 1359 spottail shiners collected in the Maumee Bay portion of western Lake Erie. The degree of parasitization of this host species may have changed considerably since 1927-1929. (Authors). 000946.

000289

Current, W. L., Janovy, J. Jr., Knight, S. A.

1979. *Myxosoma funduli* Kudo (Myxosporida) in *Fundulus kansae*: ultrastructure of the plasmodium wall and of sporogenesis. J. Proto-

zool. 26(4):574-583. (Dep. Zool. Entomol. Auburn Univ. Auburn, Ala. 36830.).

Ultrastructure of the plasmodium wall and of sporogenesis were studied in *Myxosoma funduli* Kudo infecting the gills of *Fundulus kansae* (Garman). Plasmodia were located within the lamellar tissues adjacent to sinuses and capillaries. The plasmodium wall consisted of a single unit membrane which was continuous with numerous pinocytotic canals extending into the parasite ectoplasm. The plasmodium membrane was covered by a surface coat of almost uniform thickness which prevented direct parasite-host cell contact. Numerous generative cells and cell aggregates, representing early stages of spore development, were seen in immature plasmodia. Later stages of spore development, including mature spores, were observed in older plasmodia. Sporogenesis was initiated by envelopment of one generative cell, the sporont, by a second, nondividing cell, the envelope cell. The sporont and its progeny proceeded through a series of divisions until there were 10 cells, all compartmentalized within the envelope cell. Subsequently, the 10 cells became structurally differentiated and arranged into two 5-celled spore-producing units, each consisting of one binucleate sporoplasm and two capsulogenic cells, all surrounded by two valvogenic cells. Observations of later developmental stages revealed the major events of capsulogenesis, valvogenesis, and sporoplasm maturation, which occurred concomitantly during spore construction. (Authors). 000945.

000290

Curtis, M. A., Rau, M. E.

1980. The geographical distribution of diplostomiasis (Trematoda: Strigeidae) in fishes from northern Quebec, Canada, in relation to the calcium ion concentrations of lakes. Can. J. Zool. 58(7):1390-1394. (Inst. Parasitol. McGill Univ. Macdonald Coll. Ste. Anne de Bellevue, P.Q. Canada H9X 1C0.).

All 12 species of fishes collected from lakes on the Quebec-Labrador geosyncline and the surrounding Canadian Shield exhibited diplostomiasis. Based primarily on data from *Salvelinus fontinalis*, *Catostomus catostomus*, and *C. commersoni*, the infection was rare or absent in lakes with low calcium ion concentrations but apparently ubiquitous in waters high in calcium. The occurrence of this disease reflects the local distribution of the snail intermediate host *Lymnaea arctica*, which appears restricted to waters with calcium levels of more than about 5 ppm. Such lakes characteristically overlie rock rich in dolomite. This information suggests that the distribution of diplostomia-



sis in northern Quebec can be predicted from existing geological maps. (Authors). 000891.

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000291

Delves-Broughton, J., Falwell, J. K., Woods, D.

1980. The first occurrence of cauliflower disease of eels *Anguilla anguilla* L. in the British Isles. J. Fish Dis. 3(3):255-256. (RHM Res. Ltd. High Wycombe, Buckinghamshire, England.).

A case report illustrated with a single macro-photograph. (Ken Wolf). 000787.

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000292

Deufel, J., Pollnitz, C.

1977. Cytological diagnosis of diseases of the rainbow trout (*Salmo gairdneri* Richardson). (Zytodiagnostik von Krankheiten bei Regenbogenforellen (*Salmo gairdneri* Richardson).) Beitr. Histopathol. Fische (Fisch und Umwelt) 4:15-24. (Inst. Seenforsch. Fischerereiwesen, Langenargen/Bodensee, Fed. Rep. Germany.).

An outbreak of each condition was investigated, and several specimens were examined. Qualitative and quantitative hematologic parameters of peripheral blood and hematopoietic tissues were found for viral hemorrhagic septicemia, ulcerative dermal necrosis, lipid degeneration of the liver and drug toxicity. Tabular and graphic data are provided and half-tone micrographs illustrate several of the cytological conditions discussed. The authors believe that hematologic methods will be an aid to easy and rapid diagnoses, but emphasize that viral infections require specialized virological methods. (Ken Wolf). 000785. (Paper in German)

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000293

Dulin, M. P.

1977. Incurable microsporidian diseases. Trop. Fish Hobbyist 25(7):45-48. (USDA, APHIS, NVSL, P. O. Box 844, Ames, Iowa 50010.).

A popular discussion, well-illustrated with color plates of typical cases of affected tropical fishes. (Ken Wolf). 000906.

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000294

Dulin, M. P.

1977. Ich. Trop. Fish Hobbyist 25(5):57-60. (USDA, APHIS, NVSL, P. O. Box 844, Ames, Iowa 50010.).

A brief but accurate coverage of ichthyophthiriasis — signs, diagnosis, prevention, and treatment. It is written for the tropical fish hobbyist and well illustrated in color. (Ken Wolf). 000903.

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000295

Dulin, M. P.

1977. Post-mortem examination. Trop. Fish Hobbyist 25(6):52-57. (USDA, APHIS, NVSL, P. O. Box 844, Ames, Iowa 50010.).

'How-to-do-it' for the advanced tropical fish hobbyist. Relevant for parasites and gross bacterial conditions, but understandably without giving specific identifications of etiologic agents. Useful in helping the aquarist gather facts and preserve specimens for the professional diagnostician. (Ken Wolf). 000902.

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000296

Dulin, M. P.

1977. *Camallanus*. Trop. Fish Hobbyist 25(8):60-64. (USDA, APHIS, NVSL, P.O. Box 844, Ames, Iowa 50010.).

A brief, popular article on a genus of nematodes commonly found among aquarium fishes. Written appropriately for the hobbyist. (Ken Wolf). 000895.

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000297

Ewing, W. H., Ross, A. J., Brenner, D. J., Fanning, G. R.

1978. *Yersinia ruckeri* sp. nov. the redmouth (RM) bacterium. Int. J. Syst. Bacteriol. 28(1):37-44. (Div. Biochem. Water Reed Army Inst. Res. Washington, D. C. 20012.).

Cultures of the redmouth (RM) bacterium, one of the etiological agents of redmouth disease in rainbow trout (*Salmo gairdneri*) and certain other fishes, were characterized by means of their biochemical reactions, by deoxyribonucleic acid (DNA) hybridization, and by determination of guanine-plus-cytosine (GC) ratios in DNA. The DNA relatedness studies confirmed the fact that

the RM bacteria are members of the family *Enterobacteriaceae* and that they comprise a single species that is not closely related to any other species of *Enterobacteriaceae*. They are about 30% related to species of both *Serratia* and *Yersinia*. A comparison of the biochemical reactions of RM bacteria and *serratiae* indicated that there are many differences between these organisms and that biochemically the RM bacteria are most closely related to *yersiniae*. The GC ratios of RM bacteria were approximated to be between 47.5 and 48.5%. These values are similar to those of *yersiniae* but markedly different from those of *serratiae*. On the basis of their biochemical reactions and their GC ratios, the RM bacteria are considered to be a new species of *Yersinia*, for which the name *Yersinia ruckeri* is proposed. Strain 2396-61 (= ATCC 29473) is designated the type strain of the species. (Authors). 000816.

000298

Fletcher, T. C., Grant, P. T.

1969. Immunoglobulins in the serum and mucus of the plaice (*Pleuronectes platessa*). *Biochem. J.* 115(5):65. (Inst. Mar. Biochem. St. Fitticks Road, Torry, Aberdeen AB1 3RA, Scotland.).

This is the first report of the occurrence of antibody in the mucus of fish. The authors immunized plaice with human erythrocytes, limpet haemocyanin or heat-killed *Vibrio ichthyodermis*. Although humoral antibody titers were higher, the class of mucus antibody seemed to have biochemical characteristics similar to the humoral fraction. In addition, no change of antibody class was detected upon prolonged periods of immunization. (D. Anderson). 000802.

000299

Fluchter, J.

1979. Identification and treatment of diseases in the common sole (*Solea solea* L.). *Aquaculture* 16(3):271-274. (Bayerische Landesanstalt Fisch. Starnberg, Fed. Rep. Germany.).

Three bacterial diseases (tailrot, furunculosis and red-spot disease) are described. A *Pseudomonas* was associated with the first two and a *Vibrio* with the third. Tailrot and furunculosis could be cured by treating the fish with antibiotics, but red-spot disease could not because of its very rapid progression and late on-set of signs.

Ectoparasites probably facilitate the entry of disease organisms. (Author). 000856.

000300

From, J.

1980. Chloramine-T for control of bacterial gill disease. *Prog. Fish-Cult.* 42(2):85-86. (Danish Trout Cult. Res. Stn. Broens, 6780 Skaerbaek, Denmark.).

Research at the Danish Trout Culture Research Station at Broens established the tolerance by healthy rainbow trout of various concentrations of chloramine-T (sodium para-toluene-sulfonylchloramide,  $[\text{CH}_3] \text{C}_6\text{H}_4\text{SO}_2\text{N}^+\text{NaCl}\cdot 3\text{H}_2\text{O}$ ) and the efficacy of the compound in treating bacterial gill disease. In water having a hardness of 115-120 ppm  $\text{CaCO}_3$ , a pH of 7.0-7.1, a temperature of 20°C and an oxygen saturation of 70%, healthy trout tolerated a level of 20 ppm chloramine-T for 12 h. Trout in troughs and having bacterial gill disease were cured with a single continuous flow treatment of 8.5 or 6.5 ppm for 1 h or with two treatments at 4.5 ppm. The author recommends a treatment level of 6.5 ppm for trout in troughs and 4.5 ppm for trout in ponds. Danish trout farmers have successfully used these concentrations for brown and brook trout and Atlantic salmon. (Ken Wolf). 000854.

000301

Ghittino, P., Andruetto, S.

1979. Fish vibriosis in fresh and salt waters in Italy. *Riv. Ital. Piscic. Ittiopatol.* 14(2):55-56. (Inst. Zooprofilattico Sperimentale, Via Bologna, 148, 10154 Torino, Italy.).

A brief discussion of septicemic bacterial infections in farm-raised fish in Italy. The emphasis is on vibriosis and its identification by biochemical methods. The authors cite a need for a polyvalent agglutinating antiserum. A plea is made for judicious use when antibiotic therapy is needed, and for exchange of cultures and diagnostic materials. (Ken Wolf). 000799

000302

Giavenni, R., Finazzi, M., Poli, G., Grimaldi, E.

1980. Tuberculosis in marine tropical fishes in an aquarium. *J. Wildl. Dis.* 16(2):161-168.



(Inst. Anat. Patol. Vet. Patol. Aviare, Univ. Studi, Milano, Italy.).

Skin, gill and visceral tubercle lesions were detected in marine tropical fish in an aquarium. Ninety-seven fish of 17 different genera were affected. The tubercles consisted of a wall of densely packed epithelioid cells and necrotic center packed with acid-fast bacilli identified as *Mycobacterium marinum*. (Authors). 000859.

000303

Goven, B. A., Gilbert, J. P., Gratzek, J. B.

1980. Apparent drug resistance to the organophosphate dimethyl (2,2, 2-trichloro-1-hydroxyethyl) phosphonate by monogenetic trematodes. *J. Wildl. Dis.* 16(3):343-346. (Dep. Med. Microbiol. Sch. Vet. Med. Univ. Georgia, Athens, Ga. 30602.).

*Gyrodactylus elegans* on goldfish, (*Carassius auratus*) from a commercial farm were resistant to recommended dosages of dimethyl (2,2, 2-trichloro-1-hydroxyethyl) phosphonate. Controlled experiments suggest that a dosage 100 times the commonly recommended minimal dosage (.25 mg per L) was required to remove trematodes. A hypothesis is proposed to account for the development of drug resistant trematodes based on the life cycle of the parasites and continual drug exposure. (Authors). 000855.

000304

Groberg, W. J. Jr., Voss, E. W. Jr., Fryer, J. L.

1979. Metabolism of coho salmon Ig: intraperitoneal absorption properties of coho salmon tetrameric Ig. *Fish Pathol.* 13(4):189-196. (Dep. Microbiol. Oregon State Univ. Corvallis, Ore. 97331.).

The intraperitoneal absorption properties of Ig purified from coho salmon serum were studied. In all experiments, aliquots of the radiolabeled immunoglobulin were compared in duplicate fish receiving the protein intraperitoneally and intravenously. This experimental design allowed comparative absorption efficiency and kinetic measurements. The degree and kinetics of absorption were found to be temperature dependent. It was also determined that the monomeric subunit derived from the tetramer was absorbed with lower efficiency over relatively longer periods of time. Ab-

sorption results are discussed in terms of their phylogenetic significance. (Authors). 000781.

000305

Gunnes, K.

1979. Survival and development of Atlantic salmon eggs and fry at three different temperatures. *Aquaculture* 16(3):211-218. (Dep. Anim. Genet. Breeding, Agric. Univ. Norway, As-NLH, Norway.).

Groups of Atlantic salmon (*Salmo salar*) eggs were incubated at 12, 10 and 8°C. At 12°C mortality was high and fry averaged little more than half the weight of those hatched at 10 or 8°C. Development of alevins to the swim-up stage was also abnormal at 12°C. The results suggest that 10°C is optimal for incubating Atlantic salmon eggs. For the period between hatching and swim-up, the most favorable temperature varies according to the temperature used during incubation. Mortality rate during the first 6 weeks of feeding was correlated with mortality during earlier development. Total numbers of day-degrees required by the eggs and fry to reach the eyed, hatching, and swim-up stages of development were significantly less at 12°C than at 10 or 8°C. However, total day-degrees required to reach an average weight of 0.5 or 0.6 g were almost the same regardless of temperature during hatching. (Author). 000857

000306

Harrell, L. W.

1979. Immunization of fishes in world mariculture: a review. *Proc. World Maricult. Soc.* 10:534-544. (Northwest Alaska Fish. Cent. Natl. Mar. Fish. Serv. Natl. Oceanic Atmos. Admin. 2725 Montlake Blvd. East, Seattle, Wash. 98112.).

The capability to mount an immune response against pathogens has been recognized in fish since rainbow trout (*Salmo gairdneri*) were successfully vaccinated against the bacterial disease furunculosis in 1942. Most investigations into the development of fish vaccines since that time have focused on the bacterial pathogens of salmonids.

The majority of research and development of practical vaccines for cultured fish has been realized in the past 10 years and presently the field of fish immunology is enjoying a rapid and productive growth. Interest in fish from a phylogenetic or comparative aspect led many competent individuals and institutions to explore the nature and mechanisms of the immune response in several

species. Knowledge gained from these investigations has been the foundation for work on practical vaccine development.

During the early 1970's in the Pacific Northwest, commercial growers hand vaccinated marine cultured Pacific salmon against vibriosis. Hundreds of thousands of juvenile salmon were individually injected using automatic syringes and assembly line techniques. With the advent of large-scale aquaculture operations, the necessity for an efficacious delivery system for large numbers of fish became evident. Recently, new methods and novel techniques such as immersion and spray vaccination have been developed by private, academic, and governmental agencies.

A review is given of the evolution of vaccines and vaccine delivery systems in cultured finfish. (Author). 000842

000307

Hatai, K., Egusa, S.

1979. Studies on the pathogenic fungus of mycotic granulomatosis — III. Development of the medium for MG-fungus. *Fish Pathol.* 13(3):147-152. (Central Res. Lab. Sankyo Co. Hiromachi, Shinagawa-ku, Tokyo, Japan.).

MG-fungus, causative agent of mycotic granulomatosis incubated at 25°C on the FME agar containing 10% fish meat extract added various amounts of glucose showed the best growth on the FME agar containing 1% glucose.

Among several media tested a medium which consists of 1% glucose, 0.25% yeast extract and 1.5% agar was the best for the growth of MG-fungus. This medium was named as GY-medium. The fungus grew better on the GY-medium than on the FME agar, though it grew somewhat better on a modified FME agar containing 1% glucose than on the GY-medium. The fungus was capable of growing on an agar containing 0.25% yeast extract only, but incapable on an agar with 1% glucose only. This showed that a growth factor of the fungus existed in yeast extract.

The fungus grows on neither Sabouraud dextrose agar nor Czapek dox agar. Culturing tests using the FME agar added in various concentrations the main ingredients of Sabouraud dextrose agar and those of Czapek dox agar revealed that a combination of 4% glucose and 1% peptone and that of 3% glucose and 0.1% K<sub>2</sub>HPO<sub>4</sub> inhibit the growth of the fungus. (Authors). 000920. (Paper in Japanese)

000308

Hayunga, E. G.

1980. Two atypical lesions from white suckers *Catostomus commersoni* Lacepede infected by caryophyllid tapeworms. *J. Fish Dis.* 3(2):167-172. (Biomed. Res. Inst. Am. Found. Biol. Res. 12111 Parklawn Dr. Rockville, Md. 20852.).

The histopathologic changes in one fish with a hardened fibrous necrotic and vacuolated pancreas and associated necrotic adipose tissue and a second fish with a massive growth in the gut near the site of parasite attachment are described and illustrated. The gut lesion showed loss of epithelium and lamina propria, hyperplasia of the muscularis, chronic inflammation, and numerous granulomata of submucosal tissue near the tapeworms. The cause of neither lesion was determined. (Ken Wolf). 000761.

000309

Henricson, J.

1978. The dynamics of infection of *Diphyllbothrium dendriticum* (Nitzsch) and *D. ditremum* (Creplin) in the char *Salvelinus alpinus* (L.) in Sweden. *J. Fish Biol.* 13(1):51-71. (Univ. Umea, Dep. Ecol. Zool. S-901 87 Umea, Sweden.).

A total of 654 char, *Salvelinus alpinus* (L.) from Lake Bjeljojaure, Sweden, were examined for plerocercoids of *Diphyllbothrium dendriticum* (Nitzsch, 1824) and *D. ditremum* (Creplin, 1825) from September 1969 to December 1974. Plankton samples showed that the dominating copepod species in the lake were *Eudiaptomus graciloides* (Lilljeborg), *Cyclops scutifer* Sars and *Heterocope appendiculata* Sars. *Eudiaptomus graciloides* passed the winter as adults and *C. scutifer* as copepodids while *H. appendiculata* was restricted to a short period in the summer. Copepods occurred in the stomachs in September-October and to a certain extent in April-May, but only cyclopids and *Heterocope* sp. were found. *Cyclops scutifer* is proposed to be the main first intermediate host of both *D. dendriticum* and *D. ditremum*. The potential final hosts were the common gull, *Larus canus* L. for *D. dendriticum* and the black-throated diver, *Gavia arctica* (L.), for *D. ditremum*. One common gull was experimentally successfully infected with plerocercoids of *D. dendriticum*. The parasites showed no seasonal cycle in incidence of infection. (Author). 000935.

000310

Herner, C.

1979. A myxosporidian, *Henneguya* sp. infecting the permit, *Trachinotus falcatus*. Drum Croaker 19(1):48-50. (Miami Seaquarium, Miami, Fla. 33140.).

A case report. Three kinds of treatments were tried, but no results are given. (Ken Wolf). 000937.

000311

Heuschmann-Brunner, G.

1978. Aeromonads of the *Hydrophila-Punctata*-Group in fresh water fishes. (Die Aeromonaden der *Hydrophila-Punctata*-Gruppe bei Susswasserfischen.) Arch. Hydrobiol. 83(1):99-125. (Bayer. Landesanstalt Wasserforsch. Munich, Fed. Rep. Germany.).

Aeromonads of the *Hydrophila-Punctata*-Group are ubiquitous habitants of surface waters, where they are often found in great numbers. They belong to the natural bacterial flora of fresh water fishes. Moreover, these microorganisms play a significant role as potential pathogens for fishes and other vertebrates, especially poikilothermic animals. Bacteriological investigations on numerous fresh water fishes with regard to their diseases were performed. The results and factors favoring *Aeromonas*-infections in fish are discussed. Most strains isolated from fish were identified as *Aeromonas hydrophila* subsp. *hydrophila* according to Bergey's Manual, 1974. After artificial infection many of these strains appeared to be pathogenic for carp (*Cyprinus carpio*). Fish pathogenic strains of *A. hydrophila* can be found not only in diseased fish, but also in healthy fish, in surface water and in sewage. Pathogenicity of Aeromonads of the *Hydrophila-Punctata*-Group is depending on their ability to produce toxins. Studies relating to this matter on fish and other animals and observations in man are reported. (Author). 000793. (Paper in German)

000312

Horiuchi, M., Kohga, K.

1979. Rapid diagnosis of red spot disease in cultured eels by direct immunofluorescence (IF). Bull. Jpn. Soc. Sci. Fish. 45(7):835-840. (Nihon Nosan Kogyo Co. Ltd. Res. Cent. Midori-ku, Yokohama 226, Japan.).

Red spot disease of cultured eels, caused by *Pseudomonas anguilliseptica*, has been occurring

in Japan since the early summer of 1971. Direct immunofluorescence (IF) was examined for rapid diagnosis of the disease in this study.

Antiserum was obtained from rabbit immunized with formalin-killed organisms (strain ST-1). The titer was 1:2048 by the agglutination test. IgG fraction was purified from the antiserum by ammonium sulfate precipitation and conjugated with fluorescein isothiocyanate. Free dye was removed by Sephadex gel filtration and the conjugate was purified by DEAE-cellulose column chromatography.

The F/P molar ratio of the conjugate was determined as 1.2. The conjugate had a staining titer of 1:32 and no cross-reaction was observed when *Vibrio fisheri*, *Edwardsiella tarda*, *Streptococcus* sp. and *P. fluorescens* were stained, but slight cross-reaction was seen in low dilution with *P. putida*, *P. aeruginosa*, *Aeromonas* sp. and *Vibrio anguillarum*.

The specific fluorescence in ST-1 cells was observed when acetone-fixed impression preparation or frozen section from artificially infected eels was stained. ST-1 cell was more readily detected by IF than cultivation on nutrient agar. The specific fluorescence could be observed at least 16 days at 37°C.

Although the conjugate was not evaluated on natural epizootics, the above data suggest that we could employ direct IF on impression preparations for the rapid and reliable diagnosis of this disease. (Authors). 000951. (Paper in Japanese)

000313

Ingram, G. A., Alexander, J. B.

1980. The immune response of the brown trout *Salmo trutta* to lipopolysaccharide. J. Fish Biol. 16(2):181-197. (Dep. Biol. Gardner St. Annexe, Univ. Salford, Salford, M6 6WZ, England.).

Brown trout produced high molecular weight, thermostable, dithiothreitol sensitive, nonprecipitating, complement-fixing antibodies and agglutinins to lipopolysaccharides after intramuscular injection with adjuvant. Antibodies were first detected on day 14 and reached maximum titers after 56 to 63 days when a single injection was given. When either a second or third injection was administered maximum titers occurred 34 to 40 days after the injection. After each injection the titers increased significantly, and the protein concentration of the sera was significantly decreased. In cellulose acetate electrophoresis experiments those



bands which migrated in the  $\beta$ - to  $\gamma$ -globulin regions were increased.

Antibody-secreting and antigen-binding cells were detected on days 8 and 4 respectively and maxima were reached between day 16 and day 18. The number of cells per  $10^6$  lymphoid cells was higher in the spleen than in the kidney. (Authors). 000798.

000314

Itami, T., Kusuda, R.

1980. Studies on spray vaccination against vibriosis in cultured ayu—II. Duration of vaccination efficacy and effect of different vaccine preparations. Bull. Jpn. Soc. Sci. Fish. 46(6):699-703. (Dep. Cult. Fish. Fac. Agric. Kochi Univ. Nankoku, Kochi 783, Japan.).

Duration of vaccination efficacy and effect of different vaccine preparations for control of vibriosis in cultured ayu, *Plecoglossus altivelis*, were investigated. *Vibrio anguillarum*, the etiological agent of vibriosis in ayu, was incubated in nutrient broth with shaking at 25°C. Vaccines used in this study were formalin-killed vaccine-96 and heat-killed vaccine, both were prepared from 96 h culture; and ultrasonicated vaccine and formalin-killed vaccine-48, were both prepared from 48 h culture. Procedures of spray vaccination and artificial water-borne challenge were the same as reported previously.

In the study on the duration of vaccination efficacy, formalin-killed vaccine-96, which was the most effective in the previous report, was used. Efficacy was maintained for 16 weeks, so that booster is unnecessary during almost the whole period of culturing ayu after spray vaccine is administered once.

To examine the effect of different vaccine preparations, four kinds of vaccine described above are used. Formalin-killed vaccine-96 was the most effective among them and formalin-killed vaccine-48 was the least. But ultrasonicated vaccine had almost the same efficacy as formalin-killed vaccine-96. On the basis of these results, disrupted cell walls and released intracellular components are considered to be effective as protective antigens against vibrio infection. Heat-killed vaccine was less effective than formalin-killed vaccine-96; however, it was still effective. Therefore, heat resistant antigens are considered to play an important role in the protection against vibriosis. (Authors). 000843. (Paper in Japanese)

000315

Iwama, G. K., Greer, G. L.

1980. Effect of a bacterial infection on the toxicity of sodium pentachlorophenate to juvenile coho salmon. Trans. Am. Fish. Soc. 109(3):290-292. (Minist. Environ. Fish Wildl. Branch, 400, 1019 Wharf St. Victoria, B.C. Canada V8W 2Y9.).

A mild state of bacterial kidney disease was induced in juvenile coho salmon (*Oncorhynchus kisutch*) via exposure to the infective agent in water from an adult sockeye salmon (*O. nerka*). As determined by toxicity tests, the susceptibility of the infected coho salmon to the toxic action of sodium pentachlorophenate was significantly greater than for uninfected coho salmon. (Authors). 000899.

000316

Jo, Y., Ohnishi, K., Muroga, K.

1979. *Vibrio anguillarum* isolated from cultured yellowtail. Fish Pathol. 14(1):43-47. (Fish. Exp. Stn. Tokushima Pref. Hiwasa, Tokushima, Japan.).

Some bacterial diseases such as pseudotuberculosis (*Pasteurella piscicida* infection) and streptococcal infection (*Streptococcus* spp. infection) have been prevailing among cultured populations of yellowtail (*Seriola quinqueradiata*) in Japan. In the course of diagnostic works about bacterial infections of yellowtail in Tokushima Prefecture from 1976 to 1978, it was found that an additional bacterial disease, i.e. vibriosis, had been causing considerable mortalities for those 3 years in addition to the above-mentioned two diseases.

The occurrences of the three diseases or the three pathogens in 1977 was demonstrated in a table, where it was shown that the vibriosis took place in the young fish (body weight 3.7-42.5 g) from late May to early July.

The external sign of the vibriosis was characterized by opaque or congested eyes, eroded fins, darkened body color, and hemorrhagic or necrotic lesions on body surface and musculature.

*Vibrio* sp. was isolated from these diseased fish, and submitted to characterization tests, agglutination tests with anti-*V. anguillarum* sera, and a pathogenicity test with healthy yellowtail.

Putting all the results together, the etiological agent of the disease was identified as *Vibrio anguillarum*. This is the first record of *V. anguillarum* infection in yellowtail, though another vibriosis, the causative agent of which was reported

as *Vibrio* sp. by Kusuda (1965), has been known. (Authors). 000913. (Paper in Japanese)

000317

Khan, R. A., Barrett, M., Campbell, J.

1980. *Trypanosoma murmanensis*: its effects on the longhorn sculpin *Myoxocephalus octodecemspinosus*. J. Wildl. Dis. 16(3):359-361. (Dep. Biol. Mar. Sci. Res. Lab. Memorial Univ. Newfoundland, St. John's, Nfld. Canada A1C 5S7.).

A study was undertaken to ascertain the effects of *Trypanosoma murmanensis*, on adult longhorn sculpins (*Myoxocephalus octodecemspinosus*) following experimental infection. Blood samples, taken at intervals after infection, indicated a decrease in hematocrit, hemoglobin and total plasma protein levels which did not return to normal for at least 72 days. An increase of lymphocytic cells occurred about 42 and 58 days but reverted later to normal levels. Anemia persisted despite low parasitemias and might be attributed to lytic factors released directly or indirectly by the parasite and/or an ability of the erythropoietic system to respond following the initial blood loss. (Authors). 000867.

000318

Kruse, G. O. W.

1979. Trematodes of marine fishes from South Australia. 4. *Harveytrema bisulcatum* gen. et sp. n. (Lepocreadiidae). J. Parasitol. 65(6):918-920. (Harold W. Manter Lab. Univ. Nebraska State Museum, Univ. Nebr. -Lincoln, Lincoln, Nebr. 68588.).

*Harveytrema bisulcatum* gen. et sp. n. (Lepocreadiidae: Lepocreadiinae) is described from *Achoerodus gouldii* Richardson from Pearson Island, South Australia. It resembles *Schistorchis carneus* Luhe, 1906, from *Tetrodon stellatus* from Ceylon, but differs in having a prominent cirrus sac which relates the species to *Multitestis chaetodoni* Manter, 1947, from *Chaetodon ocellatus* from Tortugas, Florida, which also has a glandular forebody. *Harveytrema* is distinguished from *Multitestis* by a collarlike tegumental fold encircling the oral sucker and a cleft posterior end. (Author). 000931.

000319

Kruse, G. O. W.

1979. Trematodes of marine fishes from South Australia. 6. *Monostephanostomum manteri* gen. et sp. n. (Acanthocolpidae). J. Parasitol. 65(6):921-923. (Harold W. Manter Lab. Univ. Nebraska State Museum, Univ. Nebr. -Lincoln, Lincoln, Nebr. 68588.).

*Monostephanostomum manteri* gen. et sp. n. (Acanthocolpidae) is described from *Arripis georgianus* from Port Willunga and *A. trutta* from Adelaide, South Australia. It is similar to *Stephanostomum* Looss, 1899, but it differs in having a single complete row of circumoral spines. (Author). 000929.

000320

Lambert, M., Euzet, L.

1980. *Polycliphora nezumiae* gen. et sp. nov. (Monogenea: Diclidophoridae) a gill parasite of *Nezumia aequalis* (Macrouridae) from Senegal. Parasitology 80(3):413-417. (Lab. Parasitol. Comparee Univ. Sci. Tech. Languedoc, Place E. Bataillon, 34060 Montpellier Cedex, France.).

The diagnosis of the genus *Polycliphora* gen. nov. is based on the large number of haptorial clamps and on their skeleton. The systematic position of the parasite is discussed. Among the Diclidophoridae, *Polycliphora nezumiae* gen. et sp. nov. becomes the type of a new sub-family. (Authors). 000882.

000321

Lankester, M. W., Smith, J. D.

1980. Host specificity and distribution of the swim-bladder nematodes, *Cystidicola farionis* Fischer, 1798 and *C. cristivomeri* White, 1941 (Habronematoidea), in salmonid fishes of Ontario. Can. J. Zool. 58(7):1298-1305. (Dep. Biol. Lakehead Univ. Thunder Bay, Ont. Canada P7B 5E1.).

*Cystidicola farionis* is reported to *Coregonus clupeaformis*, *C. artedii*, *C. hoyi*, *C. nigripinnus* (new host record), *Prosopium cylindraceum*, *Oncorhynchus gorbuscha* (new North American record), *O. kisutch*, *O. tshawytscha* (new host record), *Salmo gairdneri*, *S. trutta*, *Salvelinus fontinalis*, *S. namaycush*, *S. namaycush* × *S. fontinalis*, and *Osmorus mordax*. The last five fishes listed, however, are considered unsuitable hosts for *C. farionis* as few, if any, worms reached sexual maturity in



these hosts. *Coregonus clupeaformis* is also unsuitable as a host for *C. farionis* in lakes Superior and Nipigon. The swim-bladder nematode that matures in lake whitefish in Lake Huron and some inland lakes in northwestern Ontario may be a new species.

Factors that may affect the abundance of *C. farionis* in various fishes are examined and the relative importance of different amphipods as sources of infection is discussed.

*Cystidicola cristivomeri* matures only in hosts of the genus *Salvelinus*, including *S. namaycush* and *S. alpinus*, and is reported here for the first time in *S. fontinalis*.

Ulcerations in the wall of the swim-bladder were seen only in *S. gairdneri* infected with *C. farionis* and in *S. namaycush* infected with *C. cristivomeri*. The lesions apparently resulted when unusually large numbers of swim-bladder nematodes were present. (Authors). 000865.

000322

Leatherland, J. F., Sonstegard, R. A.

1980. Seasonal changes in thyroid hyperplasia, serum thyroid hormone and lipid concentrations, and pituitary gland structure in Lake Ontario coho salmon, *Oncorhynchus kisutch* Walbaum and a comparison with coho salmon from Lakes Michigan and Erie. J. Fish Biol. 16(5):539-562. (Dep. Zool. Coll. Biol. Sci. Univ. Guelph, Guelph, Ont. Canada N1G 2W1.).

A progressive fall in serum thyroid hormone levels was found in Lake Ontario coho salmon, *Oncorhynchus kisutch*, between May 1978 and January 1979 concomitant with an increase in goiter frequency and thyroid hyperplasia. Despite marked differences in overt goiter frequency in sexually mature adult salmon collected from Lakes Ontario (43.7%), Erie (93.5%), or Michigan (0%), serum thyroid hormone levels and thyroid histology were similar in fish from the three lakes. Two gonadotrop-like basophil cells (globular and vacuolar) were found in the pituitary, particularly in sexually maturing and mature adults and jacks. Whereas in salmon from Lakes Ontario or Michigan, the globular cells were vacuolated, in Lake Erie salmon they were not; this observation may be correlated with the absence of obvious secondary sexual characteristics in Lake Erie salmon. Serum free fatty acids serum, triglycerides and cholesterol concentrations in Lake Ontario salmon fell progressively from the condition in fish collected from the Lake in May 1978, to that of fish collected during their potamodromous migration in

November 1978 and January 1979. (Authors). 000852.

000323

Lester, R. J. G.

1979. Descriptions of two new didymozoids from Australian fishes. J. Parasitol. 65(6):904-908. (Dep. Parasitol. Univ. Queensland, St. Lucia, Brisbane, Australia 4067.).

*Nematobothrium spinneri* sp. n. is described from cysts in the body musculature of *Acanthocybium solandri* (Cuvier) caught near Brisbane. It differs from other members of the genus in that the testes, ovary, and vitellaria show multiple branching, the vitellaria extend anteriorly as far as the testes, and the uterus descends on leaving the ootype. In addition, the posterior part of the worm is retractile.

*Neometadidymozoon helici* sp. n. was recovered from cysts in the walls of the buccal cavity of *Platycephalus fuscus* Cuvier and Valenciennes caught near Brisbane. It differs from *N. polymorphis*, the only other member of the genus, in that it is smaller, constant in shape, its testes do not extend into the forebody, and the uterus forms three rather than two loops. (Author). 000932.

000324

Lester, R. J. G.

1980. Host-parasite relations in some didymozoid trematodes. J. Parasitol. 66(3):527-531. (Dep. Parasitol. Univ. Queensland, St. Lucia, Brisbane 4067, Australia.).

Adult *Neometadidymozoon helici* and *Nematobothrium spinneri* were found coiled in host connective tissue without any capsule wall of parasite origin. Eggs of *N. helici* and *Didymozoon brevicolle* passed through the gut of a teleost without harm, suggesting predation as a possible mechanism for the release of eggs in these species. An alternative mechanism in *N. helici* involved ulceration of the capsule wall and release of adults and eggs to the environment. The onset of ulceration was not dependent on temperature or on the sizes of the parasites, but may be associated with the host's spawning season. Larval didymozoids found in the intestinal wall of teleosts were ensheathed in a fine membrane of host connective tissue. When fed to other teleost species, one type from *Favonigobius exquisitus* burrowed into the

gut wall and survived for at least a month in *Sillago analis*. (Author). 000866

000325

Llewellyn, L. C.

1980. A bacterium with similarities to the red-mouth bacterium and *Serratia liquefaciens* (Grimes and Hennerty) causing mortalities in hatchery reared salmonids in Australia. J. Fish Dis. 3(1):29-39. (N.S.W. State Fish. 211 Kent St. Sydney, New South Wales, Australia.).

Blood spots in the eye and hemorrhages in the musculature of the caudal peduncle were the main indication of disease in Australian hatchery reared brook trout *Salvelinus fontinalis* (Mitchill) and Atlantic salmon *Salmo salar* L. Mortalities of 0.1-0.5% per day occurred for 3-4 weeks in fish stocked in circular ponds in the months of February and March when temperatures were falling from 23-11°C. The bacterium belonging to the family Enterobacteriaceae had similarities with *Yersinia ruckeri* (the RM bacterium) and *Serratia liquefaciens*. As a temporary designation SBS was used. It is recommended that its taxonomic position remain *sub judice* for the present. Inoculation experiments on brook trout and landlocked Atlantic salmon indicated that signs appeared 2-7 days after inoculation and that rainbow trout *Salmo gairdneri* Richardson were resistant to the disease. (Author). 000930.

000326

Lowe-Jinde, L.

1979. Some observations of rainbow trout, *Salmo gairdneri*, Richardson, infected with *Cryptobia salmositica*. J. Fish Biol. 14(3):297-302. (Dep. Zool. Univ. Guelph, Guelph, Ont. Canada N1G 2W1.).

Rainbow trout (*Salmo gairdneri*) were infected with an inoculum of infected blood containing  $10^6$  *Cryptobia salmositica*. Parasitemia was cyclical with a major peak at 14-21 days and a smaller peak at 42 days. The first peak of parasitemia was correlated with low glucose, plasma proteins, and hematocrit levels. During this time clinical symptoms (exophthalmia, ascites, pale liver and gills) of the pathogenic condition were observed. The partial disappearance of the parasites from the blood was correlated with their appearance in the peritoneal cavity. As plasma glucose, proteins, and hematocrit levels returned towards control values, the oedema and gill paleness declined. Examination of the liver and spleen showed an exudate of

fibrous matrix on their exterior surfaces. In addition, the presence of  $2-4 \times 10^3$  mm<sup>-3</sup> *Cryptobia* in asymptomatic surviving fish suggests that a chronic parasitemia can be tolerated. (Author). 000911

000327

MacMillan, J. R., Mulcahy, D., Landolt, M.

1980. Viral erythrocytic necrosis: some physiological consequences of infection in chum salmon (*Oncorhynchus keta*). Can. J. Fish. Aquat. Sci. 37(5):799-804. (Natl. Fish. Cent. Bldg. 204, Naval Support Activity, Seattle, Wash. 98115.).

Erythroid cells in chum salmon (*Oncorhynchus keta*) susceptible to infection with erythrocytic necrosis virus (ENV) were examined by light and electron microscopy. Cells of stages II, III, IV, V, and VI contained complete erythrocytic necrosis virions in the cytoplasm. Viruses closely resembling ENV were also detected in the nuclei of some erythroblasts. Some secondary consequences of ENV infection were a threefold greater mortality rate from vibriosis, a significantly decreased tolerance to oxygen depletion, and a decreased ability to regulate serum sodium and potassium in saltwater. (Authors). 000862.

000328

Margolis, L., Edwards, S. J., Hoffman, G. L., Knight, R. A., Lunde, M. N., Powers, K. G.

1978. Parasitology translations reported mainly during 1976 and 1977. J. Parasitol. 64(6):1107-1114. (Pacific Biol. Stn. Nanaimo, B.C. Canada.).

This list of translations was compiled as part of the continuing task of the standing ASP Committee on Translations. Previous lists for 1971 and 1972, and 1973-1975 were published in J. Parasitol. 61: 162-174 and 63:183-192, 398-400. A list of translations completed prior to 1971 will be published as a special issue of the Index-Catalogue of Medical and Veterinary Zoology. (Authors). 000923.

000329

Migus, D. O., Dobos, P.

1980. Effects of ribavirin on the replication of infectious pancreatic necrosis virus in fish cell cultures. J. Gen. Virol. 47(1):47-57. (Dep. Microbiol. Coll. Biol. Sci. Univ. Guelph, Guelph, Ont. N1G 2W1, Canada.).

000814.

000330

Minami, T.

1979. *Streptococcus* sp. pathogenic to cultured yellowtail, isolated from fishes for diets. Fish Pathol. 14(1):15-19. (Wakayama Pref. Cent. Freshw. Fish. Wakayama, Japan.).

The streptococcal infection of cultured yellowtail, *Seriola quinqueradiata*, occurred since 1974, resulted in serious damages to yellowtail productions every year. It is important for taking preventive methods against this disease to make clear the sources of infection. Fresh and frozen fishes used for diets in farms of the fish were examined to detect the causative bacteria.

As the result, the causative bacteria, similar to *Streptococcus faecalis* and *S. faecium*, were isolated from several species of diet fishes. Yellowtails inoculated intraperitoneally with the isolates were killed with typical symptoms of this disease. The causative bacterium was found to be alive for over 6 months under low temperature, especially frozen condition.

It was suggested that the contaminated diets with the causative bacteria may be one of the sources of infection and significant of the propagation of this disease. (Author). 000916. (Paper in Japanese)

000331

Minami, T., Nakamura, M., Ikeda, Y., Ozaki, H.

1979. A beta-hemolytic *Streptococcus* isolated from cultured yellowtail. Fish Pathol. 14(1):33-38. (Wakayama Pref. Cent. Freshw. Fish. Wakayama, Japan.).

During summer to winter in 1974, the streptococcal infection occurred among yellowtails cultured in coastal waters, and has given serious damages to yellowtail production since then.

The causative organism is a  $\alpha$ -hemolytic *Streptococcus* and similar to *Streptococcus faecalis* and *S. faecium*.

In July 1976, however, another *Streptococcus* different from the above was isolated from yellowtails cultured at two fish farms in Wakayama Prefecture.

Two isolates were found to be a  $\beta$ -hemolytic *Streptococcus* and agreed well with *S. equisimilis* in main characteristics. The organism is also different from *Streptococcus* isolated from other fishes; rainbow trouts, eels, golden shiners, menhaden in hemolysis and tolerance tests.

The strain isolated from the sample showing corneal opacity and pericarditis caused typical symptoms of this disease in pathogenicity tests. Therefore, present isolates may be responsible in part for this epizootic, too. (Authors). 000917. (Paper in Japanese)

000332

Mitchell, L. G., Listebarger, J. K., Bailey, W. C.

1980. Epizootiology and histopathology of *Chloromyxum trijugum* (Myxospora: Myxosporida) in centrarchid fishes from Iowa. J. Wildl. Dis. 16(2):233-236. (Dep. Zool. Iowa State Univ. Ames, Iowa 50011.).

The gall bladder parasite, *Chloromyxum trijugum*, shows marked host specificity within the sunfish family Centrarchidae. During 1977-78 80% of 230 bluegills (*Lepomis macrochirus*) in Iowa were infected. Prevalence in green sunfish (*L. cyanellus*) was lower (17%); one of two specimens of the hybrid *L. macrochirus*  $\times$  *L. cyanellus* was infected; orangespotted sunfish (*L. humilis*) and hybrids (*L. humilis*  $\times$  *L. macrochirus*) were not infected. Intensity of infection in bluegills varied throughout the year. Prevalence of free-floating plasmodia in bluegill gall bladders was highest (100%) during winter and spring months, and decreased to 40-50% during summer and fall. Prevalence of attached plasmodia may remain 80-100% throughout the year. Sporulation and plasmotomy were observed year-round. Plasmodia were attached to underlying epithelial cells by pseudopodia-like projections and were associated with various stages of breakdown in the mucosal layer. (Authors). 000881.

000333

Molnar, K.

1980. Renal sphaerosporosis in the common carp *Cyprinus carpio* L. J. Fish Dis. 3(1):11-19. (Vet. Med. Res. Inst. Hungarian Acad. Sci. H-1581 Budapest, P. O. Box 18 XIV, Hungary krt. 21.).

*Sphaerospora angulata* Fujita, 1912, has been identified as a frequent renal parasite of cultured carp populations in Hungary. Its prevalence



ranged from 10 to 50 per cent in the pond farms surveyed. The youngest carp infected were 2.5-3 months old. Infections were not common in one-summer fish and tended to become less frequent with increasing age of the host.

The developing stages of *S. angulata* are found in the contorted tubules of the trunk-kidney but never invade the parenchymal tissue of the trunk or head-kidneys. The pansporoblasts developing in the wide proximal segment of the renal tubules, and the spores arising from the pansporoblasts are typically coelozoic parasites, for they apparently do not damage the tubular lining epithelium, nor its brush border. The main adverse effect of *S. angulata* is probably depression of resistance owing partly to deprivation of the host of nutrients secreted by the glomeruli and partly to mechanical obstruction of the distal tubular segments. (Author). 000780.

000334

Muroga, K., Takahashi, S., Yamanoi, H., Nishibuchi, M.

1979. Non-cholera vibrio isolated from diseased ayu. Bull. Jpn. Soc. Sci. Fish. 45(7):829-834. (Fac. Fish. Anim. Husb. Hiroshima Univ. Fukuyama 720, Japan.).

In the summer of 1977, a local epizootic occurred among wild and cultured populations of ayu in Shiga Prefecture. A vibrio was isolated from diseased fish showing petechiae on the body surface and congestion of the internal organs. This vibrio was confirmed to be the causative agent of the disease by artificial infection in healthy ayu.

The isolate was examined for DNA base composition and DNA homology as well as morphological, physiological, biochemical and serological characteristics.

Biochemically and physiologically, the organism was very similar to *Vibrio cholerae* but it did not show positive agglutinating reaction against anti-*V. cholerae* sera. The percent guanine plus cytosine content was 47.0-47.7. The DNA homology value between the isolate and *V. cholerae* NIH35A3 was 86%.

On the basis of the results obtained, the organism was classified as non-cholera vibrio. (Authors). 000950.

000335

Muroga, K., Yoshimatsu, T., Kasahara, S.

1980. *Urocleidus ferox* (Monogenea: Dactylogyridae) from bluegill sunfish in Japan. Bull. Jpn. Soc. Sci. Fish. 46(1):27-30. (Fac. Appl. Biol. Sci. Hiroshima Univ. Fukuyama 720, Japan.).

A monogenean parasite was found on the gills of bluegill (*Lepomis macrochirus*) taken from the Chizuka Pond in Fukuyama City, Hiroshima Prefecture in 1978. The parasite was identified as *Urocleidus ferox*, Mueller 1934 according to the taxonomical keys of Price and McMahon (1967) and referring to the description of *Onchocleidus mucronatus* (synonym of *U. ferox*) made by Mizelle (1938).

The finding worthy of special mention is the vas deferens of the present species loops around the intestinal crus in contradiction to Yamaguti's key of diagnosing the genus *Urocleidus*.

This is the first record of this monogenean parasite in Japan, and it was considered that the parasite had been introduced from North America simultaneously with the introduction of bluegills. (Authors). 000922.

000336

Muzzall, P. M.

1980. Seasonal distribution and ecology of three caryophyllaeid cestode species infecting white suckers in SE New Hampshire. J. Parasitol. 66(3):542-550. (Dep. Zool. Univ. New Hampshire, Durham, N. H. 03824.).

The caryophyllid species found in 423 Oyster River and 350 Bellamy River white suckers were *Gliridacris catostomi* Cooper 1920; *G. laruei* Lamont 1921; and *Isoglaridacris bulbocirrus* Mackiewicz 1965 (Cestoda: Caryophyllaeidae). The prevalence and mean intensity of *G. catostomi* and *G. laruei* in Oyster River hosts were highest in spring 1975 and 1976 and in winter 1976-1977, and corresponded to the collection and examination of large suckers that had moved into the Oyster River sampling area. The mean intensity of *G. catostomi* in Bellamy River hosts was highest in spring 1975 and 1976. In the same hosts, the mean intensity of *I. bulbocirrus* was highest in spring 1975 and 1976, fall 1975, and winter 1976-1977. *Isoglaridacris bulbocirrus* and *G. laruei* were nonseasonal in prevalence and mean intensity in Oyster and Bellamy River suckers, respectively.

*Gliridacris catostomi* and *I. bulbocirrus* occurred in the anterior intestinal area of white suckers collected from both localities. *Gliridacris*

*laruei* was found throughout the intestine, but the majority of worms occurred in the posterior intestinal area. In Oyster River suckers, there was evidence that intraspecific competition occurred by *G. catostomi* and *G. laruei*. The mean size of gravid worms of these species decreased as the population density of each increased in their respective intestinal areas. As parasite intensity decreased, mean size increased. The significant correlation coefficients calculated between the prevalence and/or mean intensity of each cestode species with fish length were all positive. Male and female white suckers had similar prevalences and mean intensities of each species. The state of New Hampshire is a new locality record for *G. catostomi*, *G. laruei*, and *I. bulbocirrus*. (Author). 000874.

000337

Nakai, T., Muroga, K.

1979. Studies on red spot disease of pond-cultured eels—V. Immune response of the Japanese eel to the causative bacterium *Pseudomonas anguilliseptica*. Bull. Jpn. Soc. Sci. Fish. 45(7):817-821. (Dep. Fish. Fac. Fish. Anim. Husb. Hiroshima Univ. Fukuyama 720, Japan.).

Immune response of the Japanese eel (*Anguilla japonica*; average weight: 70 g) to formalin-killed *Pseudomonas anguilliseptica* cells administered intramuscularly was studied.

Experimental fish had no specific agglutinin acquired naturally. Agglutinating antibody was detected 2 weeks after vaccination at water temperatures from 15°C to 28°C and the antibody response persisted over a period of 7 weeks (maximum titer: 256), and even at 10°C it was detected as late as 7 weeks after vaccination (titer: 2). And the antibody response in the eels immunized at about 20°C was maintained over 5 months through the low temperature period (minimum: 7°C). The use of Freund's complete adjuvant had a promotive effect on the development of agglutinin titer (maximum: 4096). Vaccinated eels were highly protected against experimental infection with virulent *P. anguilliseptica*, and this protective immune response was demonstrated even after wintering.

These results suggest that this vaccination method will provide cultured eels with protective immunity against naturally occurring red spot disease. (Authors). 000949.

000338

Nakajima, K., Egusa, S.

1979. *Philometra* sp. found on the gonad of cultured red sea bream. Fish Pathol. 13(4):197-200. (Cent. Res. Labs. Sankyo Co. Hiromachi, Shinagawa-ku, Tokyo, Japan.).

A *Philometra* sp. (Nematoda: Philometridae) was first found on the testis and ovary of the red sea bream, *Chrysophrys major*, cultured at a farm on the coast of the Amami Island, Kagoshima prefecture. In male fish small masses of several immature female worms were found under the serous membrane of various parts of the testes, but a large mass of the mature worms was observed only in the connective area of the testes. These observations suggest the worm can develop only in this area. All the large masses of worms were covered with a thin clear membrane originated from the testis serosa. In female fish mature worms were found to be free in the parenchyma of the ovary. The whole body of the worm could not be collected perfectly, because the body wall was very thin and weak against handling and always several worms were entangled complicatedly with each other. Observation was made on the head parts of three fixed specimens. The results were as follows: body length unmeasured; maximum width 0.50-0.57 mm near uterus end and 0.98-1.06 mm behind intestine end; cuticle smooth, 3  $\mu$  thick; head broadly rounded, without papillae; pharynx 0.98-1.10 mm long, with bulbous anterior swelling of 0.10-0.12 mm in diameter; anterior ovary partially unobservable; uterus locates 0.33-0.44 mm behind head end, with spherical eggs of 16-18  $\mu$  in diameter. The present species differed from *P. spari* in not only the habitat of the worm in the host but also the location of the uterus in the gravid female worm. The latter was collected from the swim bladder of the gilthead, *Mylio macrocephalus*, and its uterus was reported to arise behind the anterior end of the intestine. (Authors). 000953. (Paper in Japanese)

000339

Nakajima, K., Egusa, S.

1979. Surface pattern and size of spores of three species of the genus *Glugea* observed with a scanning electron microscope, with special reference to a comparison between *G. plecoglossi* and *Glugea* sp. Awakura, 1974. Fish Pathol. 13(3):153-158. (Cent. Res. Labs. Sankyo Co. Hiromachi, Shinagawa-ku, Tokyo, Japan.).

Three species of the genus *Glugea* (Microsporida: Nosematidae), *G. plecoglossi*, *G. anomala* (Moniez, 1887) Gurley, 1893, and *G. hertwigi canadensis* were studied on their spore surface con-



struction and dimensions with a scanning electron microscope. Spores of *G. plecoglossi* were collected from both fresh and the formalin-preserved *Plecoglossus altivelis*. Fresh spores of *G. anomala* from *Gasterosteus aculeatus* were sent by J. Lom of the Czechoslovakia Academy of Sciences and spores of *G. hertwigi canadensis* were gathered from a frozen Canadian smelt, *Osmerus mordax*, imported commercially from Canada. These spores were fixed in 2% glutaraldehyde in 0.1 M phosphate buffer of pH 7.4 for 90 min and then in 2% osmium tetroxide in the same buffer for 60 min. After fixation, they were rinsed, dehydrated by passage through a graded series of ethanol, replaced with isoamyl acetate, dried with a critical point dryer, coated with golden ion and examined with the Hitachi MSM-6 at accelerating voltages of 25kV.

*Glugea plecoglossi* spores have the smooth surface, though an exception with a fine wrinkle-like structure was found in the formalin-preserved specimens. The treated fresh spores of *G. plecoglossi* measured 3.9-5.1  $\mu\text{m}$  long by 1.7-2.1  $\mu\text{m}$  wide, being a little smaller than the figures of 5.1-6.2  $\mu\text{m}$  long by 2.0-2.5  $\mu\text{m}$  wide reported on the basis of optical microscopic observations. The formalin-fixed spores did not shrink through the treatment. *Glugea* sp. from *P. altivelis* is distinctly different from *G. plecoglossi*, because, first, the formalin-preserved spores are bigger than those of *G. plecoglossi*, being 5.9-6.9  $\mu\text{m}$  long by 2.0-2.4  $\mu\text{m}$  wide according to an optical microscopic observation, and secondly, they have dense fine folds on the surface. *Glugea anomala* spores were characterized by the highly rugose surface with a winding longitudinal ridge. *Glugea hertwigi canadensis* spores had the rough surface with loose folds and distinct or obscure longitudinal wrinkles which was slightly different from that of *G. hertwigi* reported by Lom and Weiser in 1972. (Authors). 000926. (Paper in Japanese)

000340

Nakajima, M., Chikahata, H.

1979. Efficiency of oral and hyperosmotic vaccinations for vibriosis in ayu. Fish Pathol. 14(1):9-13. (Yamanashi Pref. Fish. Exp. Stn. Shikishima-cho, Nakakoma-gun, Japan.).

A comparison was made on the efficiency of oral and hyperosmotic vaccinations for the control of vibriosis in ayu (*Plecoglossus altivelis*), the equal dose of vaccine being used.

The formalin-killed vaccine adsorbed to compound feed was administrated to 350 fishes with a daily dose of 0.16 g per kg for 15 days. The challenge tests by *V. anguillarum* were carried out 30,

60, and 90 days after the vaccination. In the vaccinated groups, the survival rates after the challenge were 98, 86, and 78% respectively; and in the control group were 86, 52, and 50% respectively.

Three hundred and fifty fishes were dipped in 7% NaCl solution for 2 min, and then in vaccine solution for 3 min. In the vaccinated groups, the survival rates after the challenges that were started 30, 60, and 90 days after vaccination were 100, 94, and 100% respectively; and, in the control group, were 86, 52, and 50% respectively.

From the experimental results on the consecutive usage of the vaccine solution, it may be concluded that the vaccine solution can be used for at least three times. These results showed us that the hyperosmotic vaccination makes it possible to treat over three times as much of ayu as oral one. (Authors). 000915. (Paper in Japanese)

000341

Nelson, R. C.

1979. White-spot and coagulated yolk disease survey and report. Dworshak/Kooskia NFH Complex unpublished report. 21 pp. (Dworshak/Kooskia NFH Complex, P. O. Box 251, Ahsahka, Idaho 83520.).

An informal typescript report that compiles 49 responses to questionnaires that were sent to 63 fish-culturists, biologists, hatchery managers, and fish pathologists to solicit their views on white-spot disease of eggs and alevins. Twelve recommendations are given for minimizing or preventing the condition. (Ken Wolf). 000956.

000342

Nishibuchi, M., Muroga, K., Seidler, R. J., Fryer, J. L.

1979. Pathogenic *Vibrio* isolated from cultured eels — IV. Deoxyribonucleic acid studies. Bull. Jpn. Soc. Sci. Fish. 45(12):1469-1473. (Fac. Appl. Biol. Sci. Hiroshima Univ, 2-17 Midori-machi, Fukuyama 720, Japan.).

The molecular taxonomic position of a new pathogenic vibrio isolated from cultured eels has been studied. The bacterium had been classified as *Vibrio anguillarum* Type B, *V. anguillarum* f. *anguillicida*, on the basis of phenotypic properties.

The percent guanine plus cytosine content of deoxyribonucleic acid (DNA) was 46.3%, which is

within or appreciably close to the DNA base composition ranges of the existing *Vibrio* species.

Polynucleotide sequence analysis by means of optical measurement of renatured DNA, however, provided proof that the present vibrio was distinct from the existing species of the genus *Vibrio*. The isolates from diseased eels represented a homologous group (96-97% homology for reference ET-7617 strain DNA) with the genome size of 2,000 to  $2,500 \times 10^6$  daltons. On the other hand the reference strain was very distantly related to other *Vibrio* species: 12-23% related to *V. anguillarum*; 2-17% to *V. fischeri*; 14% to *V. parahaemolyticus*; 12% to *V. alginolyticus*; 9% to *V. cholerae*. Therefore the present organism was considered as a new member of the genus *Vibrio*. (Authors). 000812.

000343

Ogawa, K., Egusa, S.

1979. Six species of *Dactylogyrus* (Monogenea: Dactylogyridae) collected from goldfish and carp cultured in Japan. Fish Pathol. 14(1):21-31. (Lab. Aquacult. Biol. Dep. Fish. Fac. Agric. Univ. Tokyo, Yayoi, Bunkyo-ku, Tokyo, Japan.).

Parasitological surveys were carried out on goldfish, *Carassius auratus* and carp, *Cyprinus carpio* from April 1977 to February 1979, and six species of *Dactylogyrus* (Monogenea, Dactylogyridae) were recovered; *D. dulkeiti*, *D. formosus*, *D. anchoratus*, *D. baueri*, *D. intermedius* and *D. vastator* from goldfish and *D. anchoratus* from carp. *Dactylogyrus dulkeiti*, *D. formosus*, *D. anchoratus*, *D. baueri* and *D. intermedius* are first recorded in Japan. Descriptions are given of the chitinous parts of the above species and also of the internal structures in *D. dulkeiti* and *D. formosus*.

At present, six species of *Dactylogyrus* mentioned above from goldfish and three species (*D. anchoratus*, *D. extensus* and *D. minutus*) from carp have been reported in Japan. (Authors). 000921. (Paper in Japanese)

000344

Okihiro, M. S., Nakamura, R. M., Quinn, B. D., Chang, E. M. L., Cripps, M. C.

1979. A high incidence of tumors in butterfly fish (*Chaetodon multicinctus*) in Hawaii. Proc. World Maricult. Soc. 10:545-550. (Puget Sound Univ. Tacoma, Wash. 98416.).

In scuba dives off the Island of Maui, near Olowalu, a high incidence of tumors was observed in the butterfly fish (*Chaetodon multicinctus*). Inci-

dences of 25% (January 1976), 22% (June 1976), 22% (August 1977) and 23% (January 1978) were observed over the 2-year period of study. Observations of fish with tumors were localized to an area approximately 180 miles wide and from 20-685 miles from the shore. Of 11 species of butterfly fish seen in the study area, only the *C. multicinctus* was involved. *Chaetodon multicinctus* examined in areas adjacent to the study area were free of tumors.

Sixty-seven fish with tumors were obtained for laboratory study. One to six tumors per fish were seen only in the skin, ranging in size from 0.1 to 2.5 cm. Microscopically, smaller lesions were hyperplastic while the larger lesions were diagnosed as benign fibromas. Electron microscopy of a few tumors did not reveal the presence of virus. The cause or causes responsible for the occurrence of these high incidences of tumors in only one species of butterfly fish in a localized site in Hawaii is unknown. (Authors). 000880.

000345

Patten, B. G.

1980. Short-term thermal resistance of hexagrammid eggs and planktonic larvae from Puget Sound. Trans. Am. Fish. Soc. 109(4):427-432. (Northwest Alaska Fish. Cent. Natl. Mar. Fish. Serv. 2725 Montlake Blvd. E. Seattle, Wash. 98112.).

Eggs of the kelp greenling, *Hexagrammos decagrammus*; painted greenling, *Oxylebius pictus*; whitespotted greenling, *H. stelleri*; and larvae of these species and of lingcod, *Ophiodon elongatus*, were subjected to tests that simulated thermal stress associated with steam-powered electric stations using seawater for cooling in a once-through system. Ambient temperatures for holding the eggs and larvae were 8°C for the lingcod, 9°C for the kelp and whitespotted greenlings, and 13°C for the painted greenling. Embryos subjected to daily 4-h exposures where temperature changes were gradual, as could occur with thermal plumes passing over egg nests, survived a maximum temperature of 22°C but not 24°C. Unfed larvae were subjected to conditions simulating passage through heat exchangers (held at elevated test temperatures for 10 or 20 min with an abrupt increase and decrease from ambient) or mixing with thermal plumes (held at test temperature 1-8 h with temperatures gradually rising and decreasing from ambient). Lingcod, the most sensitive species, had a 48-h, 50% survival at 24°C for the 10-min test and at 22°C for the 20-min test. However, lingcod and kelp greenlings became torpid at 18°C for the 10- and 20-min tests. The 48-h 50% survival of the greenlings subjected to the thermal plume test

ranged from 26°C for the 1-h test to 16°C for the 8-h test. The maximum temperature increase that would not cause death or torpor to the least resistant species is 8°C. (Author). 000884.

000346

Peters, G., Delventhal, H., Klinger, H.

1980. Physiological and morphological effects of social stress in the eel, (*Anguilla anguilla* L.). (Physiologische und morphologische Effekte von sozialem Stress beim Europäischen Aal, *Anguilla anguilla* L.) Arch. Fischereiwiss. 30(2/3):157-180. (Inst. Hydrobiol. Fischereiwiss. Univ. Hamburg, Hamburg, Fed. Rep. Germany.).

The experiments were performed with eels averaging 40 cm in length and weighing 100 g. Eels exposed to social stress were kept in 50 L aquaria, one pair per aquarium. Control eels were kept in individual aquaria. Water conditions and other parameters were constant and uniform during the 4-week observation period.

The authors summarize their findings as follows: 'In every case, battles to determine rank were fought between the eels during the 5 to 10 day experimental period. These occasionally ended in the death of the loser. The dominant eels resemble the controls in almost all parameters. Subordinate animals show numerous statistically significant changes. The removable blood quantity and spleen weight decrease. Their total leucocyte counts are lower, although their leucocrits increase. This is due to the greater number of large granulocytes. The plasma cortisol concentration increases in most individuals, but in some  $\beta$ -fishes (subordinate) it decreases. The cells of the interrenal tissue are enlarged and show a greater structural heterogeneity. Changes in carbohydrate metabolism are indicated by a decrease in liver glycogen and an increase in blood glucose and lactate. Hemoglobin appears in the skin mucus of  $\beta$ -eels. In general the physiological parameters of the inferior fish show a higher variability'.

One of the tests performed by the authors was the determination of occult hemoglobin in skin mucus. This simple test was introduced in 1976; it is a rapid and dependable test for detection of handling and, otherwise exerted, stress on fish. Occult hemoglobin was present in all subordinate eels but was absent or negligible in control and dominant eels. Among control and dominant eels other parameters were similar but significant changes were found in subordinate eels. (S. F. Snieszko). 000758. (Paper in German)

000347

Piron, R. D.

1978. Spontaneous skeletal deformities in the Zebra Danio (*Brachydanio rerio*) bred for fish toxicity tests. J. Fish Biol. 13(1):79-83. (Environ. Safety Div. Unilever Res. Lab. Colworth House, Sharnbrook, Bedfordshire, England.).

Zebra Danio (*Brachydanio rerio*, Hamilton-Buchanan) tropical fish are easily maintained and bred under laboratory conditions; procedures for maintenance and breeding are described. Intensive inbreeding of this fish gave rise to a high incidence of spontaneous skeletal deformities which appear to reflect a genetic defect rather than an environmental stimulus. This finding casts doubt on the suitability of the Zebra Danio for fish toxicity testing. (Author). 000934.

000348

Plumb, J. A., Bowser, P. R.

1978. Recent developments in channel catfish virus research. Mar. Fish. Rev. 40(10):12-13. (Dep. Fish. Allied Aquacult. Auburn Univ. Auburn, Ala. 36830.).

000883.

000349

Popoff, M., Veron, M.

1976. A taxonomic study of the *Aeromonas hydrophila*-*Aeromonas punctata* group. J. Gen. Microbiol. 94(1):11-22. (Serv. Enterobacteries, Inst. Pasteur, 75015 Paris, France.).

A total of 203 characters has been determined for 68 strains of *Aeromonas* belonging to the *Aeromonas hydrophila*-*A. punctata* group. The results have been subjected to computer analysis using the coefficient of Jaccard-Sneath and the strains clustered by the method of aggregation according to the variance.

The 68 strains can be divided into two well-segregated classes on the basis of 59 variable characters, of which seven are of diagnostic value. The two classes are considered as two separate species. The first one (42 strains) is assigned to the type species of the genus, *A. hydrophila*, and it appears that the species name, *A. punctata*, is an illegitimate synonym for *A. hydrophila*. The second (26 strains) constitutes a new species for which the name *A. sobria* sp. nov. is proposed. The type



strain of this new species has been deposited under the reference CIP7433 (our strain 208). (Authors). 000815.

000350

Prabha, C., Pillai, N. K.

1979. *Pseudechetus fimbriatus* gen. et sp. nov. a caligid copepod from Kerala coastal waters. *Parasitology* 79(3):425-429. (Dep. Aquat. Biol. Fish. Univ. Kerala, Trivandrum 695007, India.).

*Pseudechetus fimbriatus* gen. et sp. nov. from the throat of a carangid is described. The new genus has the closest resemblance to *Parechetus* Pillai from which it differs in the presence of four processes instead of two on the genital segment and a pair of processes on the abdomen instead of wings. The sternal fork carries accessory tines anteriorly making it a double structure. (Authors). 000940

000351

Raikova, E. V., Suppes, V. Ch., Hoffman, G. L.

1979. The parasitic coelenterate, *Polypodium hydriforme* Ussov, from the eggs of the American acipenseriform *Polyodon spathula*. *J. Parasitol.* 65(5):804-810. (Inst. Cytol. Acad. Sci. Leningrad 190121, Russia.).

No significant differences in macro- and micro-morphology were found between the parasitic stolon and free-living polyps of *Polypodium* sp. obtained from infected eggs of the North American acipenseriform fish, *Polyodon spathula* and corresponding developmental stages of *Polypodium hydriforme* Ussov, parasitic in the Volga sterlet (*Acipenser ruthenus*). Therefore, both the American and the European forms of *Polypodium* belong to the species *P. hydriforme* Ussov. (Authors). 000948.

000352

Reichenbach-Klinke, H. H.

1974. The spot disease of pike, Danube catfish, and whitefish. (Die Fleckenseuche der Hechte, Welse und Weissfische.) *Muench. Beitr. Abwasser-Fisch-Flussbiol.* 25:60-68. (Zool. Parasitol. Inst. Univ. Kaulbachstrasse 37, 8 Muenchen 22, Fed. Rep. Germany.).

The sore disease of pike is a skin damage with characteristic patches and severe changes in the

liver and muscles. A virus can be assumed as causative agent.

The sore of the catfishes can in many cases be caused by too much light, in the case of the channel catfish a virus could be isolated.

The sore of cyprinids (except drosy) is to be sure propagated by water pollutants. No proof exists about an infectious agent. (Author). 000806. (Paper in German)

000353

Rijkers, G. T., Teunissen, A. G., Van Oosterom, R., Van Muiswinkel, W. B.

1980. The immune system of cyprinid fish. The immunosuppressive effect of the antibiotic oxytetracycline in carp (*Cyprinus carpio* L.). *Aquaculture* 19(2):177-189. (Dep. Exp. Anim. Morphol. Cell Biol. Agric. Univ. Zodiac, Marijkeweg 40, 6709 PG Wageningen, The Netherlands.).

The effect of oxytetracycline (oxyTC) upon the immune system of carp was investigated. OxyTC was administered by feeding with oxyTC-containing pellets or by intraperitoneal injection. In order to study cellular immunity, allogeneic scale transplantation was carried out. Oral administration of oxyTC had no influence upon the median survival time (MST) of the scales. However, injections with oxyTC significantly prolonged the MST from 8.5 to 11-20 days. Thus, cellular immunity was not affected by oral administration of oxyTC, but injections did have a dramatic immunosuppressive effect.

To investigate the effect of oxyTC upon humoral immunity, animals were injected with rabbit red blood cells (RaRBC). During the primary and secondary response the number of rosette forming cells (RFC) in the spleen was determined. Control animals (not treated with oxyTC) developed an anti-RaRBC response up to 25,000 RFC per  $10^6$  white spleen cells but oxyTC-treated animals always showed reduced RFC numbers. In some cases the RFC number in oxyTC-treated animals was comparable with background levels in nonimmunized control animals (4000 RFC per  $10^6$  white spleen cells). Thus, irrespective of the route of administration, the humoral immune response is depressed by oxyTC. It is concluded that both humoral and cellular immune responses of carp are suppressed during treatment with oxyTC.

Preliminary observations showed an increased number of granulocytes in the spleen of oxyTC-treated animals. It is tempting to speculate that in those cases where specific lymphoid defense mech-

anisms are blocked, the phagocytic defense system becomes more active. (Authors). 000810

000354

Robles, A.

1979. Your fishes' health. Possible gastric distress in discus: a case report. Trop. Fish Hobbyist 27(9):65. (Letterman Army Inst. Res. Presidio of San Francisco, Calif. 94129.).

Non-fatal flatulent gastric upset following a feeding of tubificid worms. (Ken Wolf). 000904.

000355

Russell, L. R.

1980. Effects of *Truttaedacnitis truttae* (Nematoda: Cucullanidae) on growth and swimming of rainbow trout, *Salmo gairdneri*. Can. J. Zool. 58(7):1220-1226. (Dep. Zool. Univ. British Columbia, No. 2354-6270 Univ. Blvd. Vancouver, B.C. Canada V6T 2A9.).

Growth and swimming abilities of fingerling and 1.5-year-old rainbow trout infected with the nematode parasite *Truttaedacnitis truttae* were examined. Control trout and trout infected in the laboratory with 5, 10, 20, 40, or 80 worms exhibited similar growth characteristics over a 10-week period within each of four experimental groups fed different rations of trout chow (1, 2, 3, or 4% of wet body weight fed per day). Decreasing growth rates showed some correlation with increasing numbers of nematode parasites. Differences between growth rates, amounts of food consumed, and food conversion efficiencies of infected and noninfected fish were not statistically significant. Critical swimming speed, fixed velocity, and burst velocity stamina tests revealed similar swimming abilities in both control and infected trout. Maximum swimming speeds attained and time to fatigue at cruising speeds were more closely related to fish size than to numbers of worms with which fish were infected. Importance to rainbow trout survival of large natural infections with *T. truttae* is discussed. (Author). 000879

000356

Rydlo, M.

1977. An uncommon parasite of the rainbow trout. (*Glossatella piscicola* — ein seltener Parasit der Regenbogenforelle.) Wien. Tierärztl. Monatsschr. 64(2):58-60. (Bundesinst.

Gewässerforsch. Fischereiwirtschaft, A-5310 Scherfling, Mondsee, Austria.).

Heavy invasion with *Glossatella piscicola* was found on the body-surface of rainbow trout fingerlings. The possible pathogenicity caused by this species is discussed. (Author). 000796. (Paper in German)

000357

Sakaguchi, S., Matsusato, T.

1978. On a nematode, *Philometra* found in a red sea bream, *Chrysophrys major*-I. Morphological characteristics and taxonomic consideration. Bull. Nansei Reg. Fish. Res. Lab. 11:27-32. (Nansei Reg. Fish. Res. Lab. Dir. Admin. Sect. Inland Sea Fish. Resour. Res. Div. Aquacult. Res. Div. Oceanogr. Res. Div. 7782-9 Maruishi Ono-cho, Saiki-gun, Hiroshima Pref. 739-04, Japan.).

A species of nematode was found in the body cavity of a red sea bream, *Chrysophrys major* caught by a commercial fishing boat in Kariya bay, Saga prefecture. This parasite had never been reported previously from red sea bream in Japan. The parasite was observed morphologically in detail to compare with other similar species.

The specimen, fixed in 10% formalin solution was 185 mm long and 1.2 mm wide, with cylindrical shape, except both extremities. The cuticle was thin with a smooth surface. The oesophagus was muscular, measuring 1.1 mm long and 0.13 mm wide. The nerve ring was situated at a distance of 0.2 mm from the tip of the head. At the back of the nerve ring, the oesophagus gland is located dorsal to the oesophagus. The intestine which ends blindly near the tail was very large and along with the uterus occupies most of the body cavity. The uterus was packed with larvae and eggs of different developmental stages. The uterus ended behind the anterior portion of intestine. The cylindrical ovaries were located at each end of the uterus.

The larvae were filariform and range between 380-490 $\mu$  long and 11-13 $\mu$  wide. The oesophagus was a narrow muscular homogeneous tube which protruded into the lumen of the intestine. The anus was situated at approximately one-third of body length from the posterior end.

From these observations, the present specimen could be identical with *Philometra spari* detected in the swim bladder of *Sparus macrocephalus*. This species is distinguishable from other members of the genus *Philometra*, because only in this species is the distal end of the uterus located behind the



anterior extremity of the intestine. (Authors). 000952. (Paper in Japanese)

000358

Sakai, D. K.

1979. Invasive routes of *Aeromonas salmonicida* subsp. *salmonicidae*. Sci. Rep. Hokkaido Fish Hatchery 34:1-6. (Nakanoshima, Toyohira-Ku, Sapporo, Hokkaido, Japan.).

Invasive routes of *Aeromonas salmonicida* subsp. *salmonicida*, the pathogen of salmon furunculosis, were discussed by several inoculation tests, using the yearling of masu salmon (*Oncorhynchus masou*). The mortalities of the fish through intraperitoneal and intramuscular injections ( $10^8$  viable cells per fish) were 100%. When the fish were bathed with the bacterial cell-suspension ( $10^8$  per ml) for 30 min, the normal (unhurt) fish completely survived. However, the mortalities of fish injured by cutting the caudal fin and the dorsal fin were 80% and 60%, respectively. To investigate an invasion via the stomach or via the intestine, the cell-suspension ( $10^8$  per fish) was inoculated into the stomach or the intestine through fine polyethylene tubes inserted from the mouth or the anus. The mortalities through the inoculations via the stomach and via the intestine were 50% and 10%, respectively.

These results suggest the following points: first, *A. salmonicida* subsp. *salmonicida* does not cause an invasion through the unhurt gills or the unhurt epidermis, but this pathogen invades into the fish through the injury of the fin; second, there is an apparent infection via the stomach, but an infection via the intestine demonstrates only a low mortality. Hence, there are two invasive routes in *A. salmonicida* subsp. *salmonicida*: a percutaneous infection through the epidermal injury and an infection through the digestive canal. (Author). 000876. (Paper in Japanese)

000359

Sako, H., Kusuda, R., Tabata, T.

1979. Chemotherapeutical studies on trimethoprim against vibriosis of pond-cultured ayu—II. Tissue levels after administration of trimethoprim-sulfadoxine mixture. Fish Pathol. 14(2):65-70. (Nat. Res. Inst. Aquacult. Tamaki-cho, Watarai-gun, Mie, Japan.).

The present study was designed to investigate the pharmacodynamic properties of trimethoprim (TMP) in ayu, *Plecoglossus altivelis*, after oral administration of TMP-sulfadoxine (SDX) mixture

for the control of vibriosis. The results obtained are summarized as follows: (1) Following a single administration of 30 mg of TMP-SDX (1:5) mixture per kg body weight, the highest tissue levels of TMP were obtained 2 h after medication in the liver at the level of 10.8 mcg per g, 6 h in the kidney at the level of 4.4 mcg per g, 2-3 h in the muscle at the level of 1.8 mcg per g, and 1 h in the blood at the level of 0.4 mcg per ml. (2) Following daily administration of 30 mg of TMP-SDX (1:5) mixture per kg body weight per day for 10 days, TMP level became undetectably low 24 h after the last medication in the liver, 48 h in the kidney and the muscle, and 6 h in the spleen and the blood. (3) It is concluded that TMP is once retained in the tissue for some hours, and is excreted almost completely from the fish body within a day. Therefore, it is necessary to administer TMP-SDX mixture to ayu more than once a day to maintain constant tissue levels of TMP in ayu. (Authors). 000947. (Paper in Japanese)

000360

Sanaullah, M., Ahmed, A. T. A.

1980. Gill myxoboliasis of major carps in Bangladesh. J. Fish Dis. 3(4):349-354. (Aquacult. Exp. Stn. Mymensingh, Bangladesh.).

Recent heavy mortality among Indian carp of the genera *Catla*, *Labeo* and *Cirrhina* was associated with significant myxosporidan infestation of the gills and signs of respiratory distress. In all, 358 specimens were examined, and the overall incidence of infestation was 55%. Affected fish were lethargic, inappetent, stunted or emaciated, and weak. Respiratory rate was increased, and gills were pale. Large cysts were present in the gills and consisted of spores of *Myxobolus* and proliferated host tissue. The myxosporidan was considered to be the cause of the disease but not the sole cause of death. Macro and microphotographs are provided. (Ken Wolf). 000839.

000361

Savan, M., Dobos, P.

1980. Effect of virazole on rainbow trout *Salmo gairdneri* Richardson fry infected with infectious pancreatic necrosis virus. J. Fish Dis. 3(5):437-440. (Dep. Vet. Microbiol. Immunol. Univ. Guelph, Guelph, Ont. N1G 2W1, Canada.).

Fry were infected with culture-grown virus by a combination of immersion and free ingestion. An hour later lots of 200 were treated with virazole in water for 2 h at concentrations of 5 to 400  $\mu$ g per

ml. Other lots were similarly treated after 9 days when infectious pancreatic necrosis mortality began. Death rates were reduced somewhat (significant at the 5% level), but the results were not linearly related to drug concentration. The authors conclude that repeated treatments would be economically prohibitive. (Ken Wolf). 000907.

000362

Seagrave, C., Bucke, D.

1979. Research reports on two emerging kidney diseases. Water threat to fingerlings. Fish Farmer 2(4):28-29. (Minist. Agric. Fish Food, Fish Dis. Lab. The Nothe, Weymouth, Dorset, England.).

A popular account of proliferative kidney disease, particularly as it occurs in England. The authors list the probable effects that the condition has on affected fish and solicit farmers' cooperation in obtaining more information on kidney abnormalities. (Ken Wolf). 000800.

000363

Sills, J. B., Allen, J. L.

1979. Residues of formaldehyde undetected in fish exposed to formalin. Prog. Fish-Cult. 41(2):67-68. (Southeastern Fish Control Lab. P.O. Box 9, Warm Springs, Ga. 31830.).

Channel catfish, coho salmon, largemouth bass, and rainbow trout were exposed to various levels of formalin for 1-3 h and analyzed for residues at 0, 1, and 24 h after treatment. No free formaldehyde was detected in the fish tissues. (Ken Wolf). 000928.

000364

Skorping, A.

1980. Population biology of the nematode *Camallanus lacustris* in perch, *Perca fluviatilis* L. from an oligotrophic lake in Norway. J. Fish Biol. 16(5):483-492. (Univ. Oslo, Zool. Mus. Oslo, Norway.).

Samples of perch, *Perca fluviatilis*, were examined for the contents of their gastrointestinal tract and for the intestinal nematode *Camallanus lacustris* (Zoega). The seasonal dynamics, dispersal pattern and site preference of the nematode were studied. Both larvae and adult worms were present in the perch throughout the year. The abun-

dance of *C. lacustris* was non-seasonal, but seasonal cycles were found in the numbers of larvae and of gravid females. *Camallanus lacustris* showed a tendency to an increase in mean intensity with the size of perch. The frequency distribution of the nematode followed the negative binomial at different times of the year and in different length groups of perch. *Camallanus lacustris* showed a seasonal site preference in the perch gut. (Author). 000875

000365

Smit, G. L., Hattingh, J., Burger, A. P.

1979. Haematological assessment of the effects of the anaesthetic MS 222 in natural and neutralized form in three freshwater fish species: haemoglobin electrophoresis, ATP levels and corpuscular fragility curves. J. Fish Biol. 15(6):655-663. (Dep. Zool. Statistics, Rand Afrikaans Univ. P. O. Box 524, Johannesburg 2000, South Africa.).

The effects of MS 222 and neutralized MS 222 anaesthesia on haemoglobin electrophoresis, erythrocyte adenosine triphosphate (ATP) levels and corpuscular fragility curves were studied in *Cyprinus carpio*, *Sarotherodon mossambicus* and *Salmo gairdneri*. Haemoglobin electrophoresis showed no significant intra-species differences in the percentage composition of the various fractions for any concentration of MS 222 and neutralized MS 222 used. Significant interspecies differences were, however, still observed. ATP levels showed intra- and interspecies differences ascribed to the response of the fish species to MS 222-induced stress and not to actual changes in erythrocyte ATP concentrations. Differences were also observed in corpuscular fragility curves for all three species when using MS 222 or neutralized MS 222 compared to curves obtained without the use of the anaesthetic, but the mechanisms involved are not clear. (Authors). 000790

000366

Smit, G. L., Hattingh, J., Burger, A. P.

1979. Haematological assessment of the effects of the anaesthetic MS 222 in natural and neutralized form in three freshwater fish species: intraspecies differences. J. Fish Biol. 15(6):645-653. (Dep. Zool. Statistics, Rand Afrikaans Univ. P. O. Box 524, Johannesburg 2000, South Africa.).

The effects of different concentrations of natural MS 222 and neutralized MS 222 were studied on

the haematology of *Cyprinus carpio*, *Sarotherodon mossambicus* and *Salmo gairdneri*. As judged from the results, MS 222, which is acidic in nature, produced haemoconcentration effects in all species studied, being least in the trout followed by carp and *Sarotherodon mossambicus*. These differences are ascribed to acid-base regulatory functions and metabolic activities of the fish species investigated. The use of neutralized MS 222 improved the haematological profiles markedly and resulted in stabilization of acid-base parameters and red blood cells sizes and numbers. Haemoconcentration effects, however, still persisted. Trout were found to be more susceptible to the stress of MS 222 anaesthesia than carp and *Sarotherodon mossambicus*. (Authors). 000789.

000367

Smit, G. L., Hattingh, J., Burger, A. P.

1979. Haematological assessment of the effects of the anaesthetic MS 222 in natural and neutralized form in three freshwater fish species: interspecies differences. J. Fish Biol. 15(6):633-643. (Dep. Zool. Statistics, Rand Afrikaans Univ. P. O. Box 524, Johannesburg 2000, South Africa.).

Interspecies haematological differences to MS 222 and neutralized MS 222 anaesthesia were investigated in *Sarotherodon mossambicus*, *Cyprinus carpio* and *Salmo gairdneri* acclimated under identical laboratory conditions. Anaesthesia with MS 222 resulted in a chemical stress in all fish, as was evident from changes in the haematological profiles of the animals. Such species specific variations in the haematology persisted throughout the whole experiment protocol which employed different concentrations of the anaesthetic. The use of neutralized MS 222, whereby aquarium water quality remained unchanged, improved the haematological profile. Possible reasons for the interspecies differences observed are discussed. (Authors). 000809.

000368

Smith, C. E., Inslee, T.

1980. Interlamellar *Henneguya* infestation in adult channel catfish *Ictalurus punctatus* (Rafinesque). J. Fish Dis. 3(3):257-260. (U.S. Fish Wildl. Serv. Fish Cult. Dev. Cent. Bozeman, Mont. 59715.).

Mortality among mature channel catfish was attributed to acute respiratory distress that was associated with hyperplasia of gill lamellae. Epithe-

lial proliferation occurred around interlamellar cysts of *Henneguya* sp. which in turn may have been initiated by *Chilodonella* sp. The protozoan infestation may have predisposed the fish, thus allowing the lethal interlamellar myxosomiasis to occur. Micrographs of histologic sections are provided. (Ken Wolf). 000788.

000369

Smith, L. S.

1979. Focus on fish gills. Diseases and other fatal problems. Pet age 8(12):34-39. (Fish. Res. Inst. Univ. Washington, Seattle, Wash. 98195.).

A short discussion of fish gill functions and vulnerability to anoxia, metabolites, toxicants, bacteria, and parasites. Written for the tropical fish hobbyist. (Ken Wolf). 000901.

000370

Sogandares-Bernal, F., Heitala, H. J., Gunst, R. F.

1979. Metacercariae of *Ornithodiplostomum ptychocheilus* (Faust, 1917) DuBois, 1936 encysted in the brains and viscera of red-sided shiners from the Clark-Fork and Bitterroot Rivers of Montana: an analysis of the infected hosts. J. Parasitol. 65(4):616-623. (Dep. Biol. Southern Methodist Univ, Dallas, Tex. 75275.).

Red-sided shiners (*Richardsonius balteatus*) infected with the metacercariae of *Ornithodiplostomum ptychocheilus* in the brains and viscera were studied to determine if the parasite load had any effect on stamina. A special chamber and electronic circuitry used for these studies are described. Statistical treatment of data derived from the experiments is by multivariate contingency table analysis. Parasites were not found to affect the stamina of the infected fish hosts, and the evolutionary significance of this feature is discussed. (Authors). 000813.

000371

Solangi, M. A., Overstreet, R. M.

1980. Biology and pathogenesis of the coccidium *Eimeria funduli* infecting killifishes. J. Paraistol. 66(3):513-526. (Gulf Coast Res. Lab. Ocean Springs, Miss. 39564.).



Epizootics of *Eimeria funduli* involved estuarine killifishes (*Fundulus grandis*, *F. pulvereus*, *F. similis*, and *F. heteroclitus*) in Mississippi, Alabama, and Virginia. All of more than 500 specimens examined of *F. grandis* from Mississippi during 1977 through 1979 had infections, regardless of age, sex, or season collected. Oocysts occurred primarily in the liver and pancreas, replacing up to 85% of both those organs. Infrequent sites of infection were fatty tissue of the body cavity, ovary, intestine, and caudal peduncle. Living fish did not discharge oocysts. *Eimeria funduli* is the first known eimerian to require a second host. To complete the life cycle, an infective stage in the grass shrimp *Palaemonetes pugio* had to be eaten. In 6-month-old killifish reared in the laboratory at 24°C, young schizonts were first observed in hepatic and pancreatic cells 5 days postfeeding, followed by first generation merozoites by day 10, differentiation of sexual stages during days 15 to 20, fertilization between days 19 and 26, sporoblasts from days 25 to 30, and sporozoites about day 60. Unique sporopodia developed on sporocysts by day 35 when still unsporulated. Temperatures of 7 to 10°C irreversibly halted schizogony. Both schizogony and sporogony progressed slower as age of host increased. When infective shrimp in doses ranging from 1 to 10% of a fish's body weight were eaten, the level of intensity of resulting infections did not differ significantly. Pathogenesis followed a specific sequence, with the host response apparently unable to contend with extensive infections as seen typically in nature and in our experiments. Premunition was indicated. When administered Monensin orally, infected fish exhibited a reduction in oocysts by 50 to 70% within 20 days as compared with untreated fish. Furthermore, infected killifish maintained exclusively on a diet of TetraMin for 3 months completely lost their infections. (Authors). 000860.

000372

Spannhof, L., Nasev, D., Kreutzmann, H. L.

1979. Early recognition of metabolic disturbances in trout (*Salmo gairdneri* Rich.) stocks. *Aquaculture* 18:317-323. (Dep. Biol. Wilhelm Pieck Univ. Rostock. Universitätsplatz 2, 25 Rostock, Fed. Rep. Germany.).

A method is proposed for detecting metabolic disturbances or diseases in trout stocks before typical symptoms appear. The method involves determination of erythrocyte numbers, hemoglobin contents, and hematocrit readings for about 10 animals. The measured parameters are tested for independence. The results permit the stocks tested

to be classified as normal or not normal. (Authors). 000942.

000373

Specker, J. L., Schreck, C. B.

1980. Stress responses to transportation and fitness for marine survival in coho salmon (*Oncorhynchus kisutch*) smolts. *Can. J. Fish. Aquat. Sci.* 37(5):765-769. (Oregon Coop. Fish. Res. Unit, Ore. St. Univ. Corvallis, Ore. 97331.).

Smolting coho salmon (*Oncorhynchus kisutch*) were transported experimentally at low and high densities (12 and 120 g per L) for short and long periods (4 and 12 h). Because smolts can be transplanted directly to seawater, half of the fish in each treatment were transported to tanks containing seawater and half to tanks containing freshwater. Plasma corticosteroids and glucose were elevated at unloading in all groups, and corticosteroids were still above the resting level 24 h later. Potential smoltification indicators such as plasma thyroxine concentration and gill (Na<sup>+</sup>/K<sup>+</sup>)-ATPase activity were not affected by transportation. Increased corticosteroids were correlated to increased mortality in transported salmon compared to acclimated control fish when subjected to a bioassay of stress — severe confinement. The various transport regimens did not cause increased expression of latent bacterial kidney disease. In a further experiment, smolting coho salmon were released into a stream after transport for different durations. The number of fish migrating on the 1st day appeared to be inversely related to the degree of stress en route, but the movements of all groups were similar thereafter. We concluded that transportation caused stress in the fish regardless of hauling regimen; that increased corticosteroids may have potential as indicators of reduced performance capacity; that the greatest stress occurred during loading and the first few hours en route; and that transported smolting coho salmon seem to be equally fit for entry into freshwater or seawater. (Authors). 000870.

000374

Strange, R. J.

1980. Acclimation temperature influences cortisol and glucose concentrations in stressed channel catfish. *Trans. Am. Fish. Soc.* 109(3):298-303. (Dep. For. Wildl. Fish. Univ. Tennessee, P. O. Box 1071, Knoxville, Tenn. 37901.).

Basal concentrations of plasma cortisol (near 50 ng per ml) and plasma glucose (near 0.50 mg/ml)



were significantly greater in yearling channel catfish (*Ictalurus punctatus*) acclimated to 10°C than in fish adapted to 20 or 30°C; the latter groups had similar basal levels of cortisol (near 25 ng per ml) and glucose (near 0.30 mg per ml). Fish at 10°C had a slower and less marked increase in cortisol and glucose over minutes, hours, and days in response to the stress of severe confinement than fish at 20 or 30°C which were again similar. No mortality occurred in the fish stressed at 10°C during 3 days of confinement, while 89% died in the 20°C group by day 3 and all fish at 30°C were dead by day 2. Glucose concentrations initially rose more slowly than those of cortisol, but continued to increase between 3 and 12 h after confinement. Also, glucose returned to near basal levels in dying fish while cortisol was at its highest then. Channel catfish, even at warm temperatures, have a slower and less extensive cortisol response to stress, taking 3 days to reach 225 ng per ml, than other fish that have been investigated. (Author). 000868.

000375

Strasidine, G. A., McBride, J. R.

1979. Serum antibiotic levels in adult sockeye salmon as a function of route of administration. *J. Fish Biol.* 15(1):135-140. (Fish. Oceans Canada, Technol. Serv. Branch, 6640 N.W. Mar. Drive, Vancouver, B.C. V6T 1X2, Canada.).

Adult sockeye salmon, *Oncorhynchus nerka* (Walbaum), in three different stages of sexual maturity were administered the antibiotic, oxytetracycline, by injection (intraperitoneal and intramuscular), water bath exposure and stomach capsule implant. Concentrations of the antibiotic in, and its disappearance from the serum were determined. For all three stages of sexual maturity the most efficacious route of administration based on maximum titer and duration in the serum was provided by intraperitoneal injection. Intramuscular application produced a positive effect, albeit at a markedly lower level, in all three groups of fish. Oral implants resulted in only a minor uptake of the antibiotic in the fully ripe fish. Immersion of the fish in water solutions of oxytetracycline was without effect. (Authors). 000912.

000376

Suriano, D. M., Beverley-Burton, M.

1979. *Internilocus chilensis* gen. et sp. nov. (Monogenea: Capsalidae) representative of a new sub-family: Interniloculinae gill parasite of *Helicolenus lengerichi* Norman (Pisces: Scorpenidae)

of the South Pacific Ocean. (*Internilocus chilensis* gen. et. sp. nov. (Monogenea: Capsalidae) representant d'une nouvelle sous-famille: Interniloculinae parasite des branchies de *Helicolenus lengerichi* Norman (Pisces: Scorpenidae) de l'Océan Pacifique Sud. *Can. J. Zool.* 57(6):1201-1205. (Consejo Natl. Invest. Cientificas y Tecnicas, Rivadavia 1917, Capital Fed. Rep. Argentina.).

The new subfamily Interniloculinae, characterized by the presence of four testes, the position of the vagina, lack of eye spots, and the anatomy of the haptor with 14 peripheral and three internal loculi is placed in the family Capsalidae Baird, 1853. Consequently, the familial diagnosis of Bychowsky 1957 is amended. *Internilocus chilensis* is the type genus and species of this newly proposed subfamily. The parasite was found on the gills of *Helicolenus lengerichi* (chancharro), a bottom-dwelling teleost from the coastal waters of central Chile. (Authors). 000797. (Paper in French)

000377

Suzuki, A., Sekizawa, Y.

1979. Residue analyses on 2-amino-4-phenylthiazole, a piscine anesthetic, in fishes-IV. GC/MS analysis on rainbow trout. *Bull. Jpn. Soc. Sci. Fish.* 45(2):167-171. (Res. Lab. Meiji Seika Kaisha, Ltd. Morooka-cho, Kohoku-ku, Yokohama, Japan.).

When a piscine anesthetic, 2-amino-4-phenylthiazole, was absorbed by rainbow trout, *Salmo gairdneri irideus*, from an anesthetic solution, a whole body concentration of 6.7 and 13 ppm was attained at 3 h and 6 h, respectively. After anesthetization for 6 h, fish were transferred into 500 L of fresh water flowing at a rate of 2 L per min. The anesthetic previously absorbed by the fish was excreted into the environmental water by this process. Residues of the anesthetic in the fish were measured by gas chromatography-mass spectrometry (GC/MS). The total concentration of anesthetic in the fish declined at a rate comparable to that predicted by a computed theoretical biexponential curve obtained by a previously described mathematical procedure. The biological half-life of the anesthetic under these experimental conditions was approximately 40 min in the primary step and 22 h in the secondary step. The whole body residues which remained at 24 and 48 h were 0.1 ppm and 0.05 ppm, respectively. (Authors). 000775.

000378

Szerow, D.

1980. Health of carp in fish farms. (Problemy zdrowotności karpia w gospodarstwach stawowych.) *Gospodarka Rybna* 32(5):7-8. (Fish Dis. Lab. Wrocław, Poland.).

During the period of 1970-79, fish farms in western Poland suffered increased losses among 1 and 2 year-old carp. The most important causes of mortality were an acute form of spring viremia of carp and inflammation of the gas bladder; the two conditions are believed to have the same etiology. Other infectious diseases contributing to losses were necrotic mycoses of gills, and diseases caused by protozoans and helminths. Gill necrosis, due to pollution by products of fish metabolism (chiefly free ammonia), also caused losses among yearling carp. Increased losses were attributed to intensification of carp culture, the use of waters of marginal suitability, inadequate nutrition, and pollution by fish metabolites. Periodic drying and cultivating pond bottoms is important in eliminating pathogens and parasites, it also increases soil fertility. Improvement of environmental conditions, which deteriorate when fish culture is intensified is essential. (S. F. Snieszko). 000808. (Paper in Polish)

000379

Takeuchi, L., Takeuchi, T., Ogino, C.

1980. Riboflavin requirements in carp and rainbow trout. *Bull. Jpn. Soc. Sci. Fish.* 46(6):733-737. (Lab. Fish Nutr. Tokyo Univ. Fish. Konan-4, Minato-ku, Tokyo 108, Japan.).

The anorexia, poor growth, and high mortality rate were observed in both fish species as the general deficiency symptoms of riboflavin. Together with these symptoms, hemorrhage of the skin and the fins in the carp and lesion of the fins and cataract in the rainbow trout were characteristic signs of the deficiency. (Authors). 000841. (Paper in Japanese)

000380

Taylor, A. L., Solomon, D. J.

1979. Critical factors in the transport of living freshwater fish — I. General considerations and atmospheric gases. *Fish. Manage.* 10(1):27-32. (Salmon Freshw. Fish. Lab. Minist. Agricult. Fish. Food, 10 Whitehall Place, London SW1A 2HH, England.).

Factors which can influence the success of carriage of live freshwater fish are discussed, including condition of fish, container design, density, temperature, dissolved oxygen and carbon dioxide, and the use of saline solutions. Procedures to maintain acceptable conditions are suggested. (Authors). 000958.

000381

Ugajin, M.

1979. Studies on the taxonomy of major microflora on the intestinal contents of salmonids. *Bull. Jpn. Soc. Sci. Fish.* 45(6):721-731. (Nakagawa Branch Tochigi Pref. Fish. Exp. Stn. Ogawa-machi, Nasu District 432-3, Japan.).

Eighty-eight strains of isolates from intestinal contents of salmonids were subjected to taxonomic analysis.

The results are summarized as follows: (1) Thirty isolates which belonged to genus *Vibrio* were isolated from intestinal contents of king salmon (*Oncorhynchus tshawytscha*) reared in sea water were identified *Vibrio fischeri*. (2) Thirty isolates which belonged to genus *Aeromonas* were isolated from intestinal contents of maso salmon (*Oncorhynchus masou*) reared in fresh water were identified *Aeromonas hydrophila* (or *Aeromonas punctata*). (3) Twenty-six isolates, lactose undecomposing or delayed decomposing strains, of 28 strains which belonged to the family Enterobacteriaceae were isolated from intestinal contents of maso salmon (*Oncorhynchus masou*) reared in fresh water were identified *Hafnia alvei*. (Author). 000939. (Paper in Japanese)

000382

Urawa, S., Muroga, K., Izawa, K.

1979. *Caligus orientalis* Gussev (Copepoda) parasitic on akame (*Liza akame*). *Fish Pathol.* 13(3):139-146. (Dep. Fish. Fac. Fish. Anim. Husb. Hiroshima Univ. Fukuyama, Japan.).

In July 1977, a numerous number of akame (*Liza akame*) with skin ulcer had been observed in the estuary of the River Ashida in Fukuyama city. Diseased fish were infected with a caligid parasite.

The parasite was identified as *Caligus orientalis* Gussev, 1951 from the results of detailed observation.

Akame is a new host of this species. (Authors).  
000925. (Paper in Japanese)

000383

Uznanski, R. L., Nickol, B. B.

1980. A sequential ranking system for developmental stages of an acanthocephalan, *Leptorhynchoides thecatus*, in its intermediate host, *Hyalella azteca*. J. Parasitol. 66(3):506-512. (Sch. Life Sci. Univ. Nebraska-Lincoln, Lincoln, Nebr. 68588.).

Based on morphological features, 22 stages were defined in the development of *Leptorhynchoides thecatus* in its intermediate host, *Hyalella azteca*. The ranking system allows close comparison of development and growth within or among amphipods, and is amenable to nonparametric statistics. Certain aspects of *L. thecatus* development are re-described. Apical nuclei arise from the central, nuclear mass, rather than a cortical nucleus. Lateral, nucleated bands, previously thought to be somatic muscle anlagen, are actually the median longitudinal canals. The body cavity develops in a single step as muscles of the body wall and the median longitudinal canals separate from the proboscis receptacle and genital strand. Developmental anomalies (short, conical proboscis, misaligned hooks, and ventrally shortened trunk) were observed and are thought to be induced by high temperatures. (Authors). 000846.

000384

van den Broek, W. L. F.

1979. Infection of estuarine fish populations by *Cryptocotyle lingua* (Creplin). J. Fish Biol. 14(4):395-402. (Dep. Biol. Sci. City London Polytech. Old Castle St, London E1, England.).

Fish populations in the Medway Estuary become infected with *Cryptocotyle lingua* (Creplin) shortly after their inshore migrations. The present study examines infection levels between 1973 and 1975 in four fish species; whiting *Merlangius merlangus* (L.), pouting, *Trisopterus luscus* (L.), plaice, *Pleuronectes platessa* L. and flounder, *Platichthys flesus* (L.). Frequency of infection was highest in flounder, followed by pouting, plaice, and whiting. Unusually, parasite density was lowest in plaice even though gastropod molluscs (the parasite's first intermediate host) were most common in their diet. Seasonal levels of infection are discussed and prove useful indicators to the migratory movements of individual fish populations. In whiting and pouting, incidence of infection increased with

length of host while no relationship between infection and age of host was observed in either flatfish. Metacercariae were not distributed randomly over the body surface; in gadoids they were concentrated above the lateral line while in pleuronectids they were most intense in the fins and gills. (Author). 000848.

000385

van den Broek, W. L. F.

1979. Copepod ectoparasites of *Merlangius merlangus* and *Platichthys flesus*. J. Fish Biol. 14(4):371-380. (Dep. Biol. Sci. City of London Polytech. Old Castle St. London, E.1, England.).

Seasonal changes in the levels of copepod ectoparasitic infections from *Merlangius merlangus* and *Platichthys flesus* were examined and related to the annual migrations of young fish into an estuary. *Lernaeocera branchialis* (L.) was the only parasite common to both fish species; its life-cycle stages infected the branchial chambers of 96.7% flounders (*P. flesus*) and 40.4% whiting (*M. merlangus*). Infection in the two fish species exhibited similar seasonal fluctuations and a temporal relationship between the parasite's occurrence on its two hosts was apparent. Whiting were also parasitized by *Clavella uncinata* (Muller); 26.9% fish were affected. The copepods' distribution was highly localized with the majority restricted to the long gill rakers of the first gill arch. Infection was related to size of whiting up to 12.5 cm; there was little increase beyond this length. In addition to *L. branchialis*, flounder was also host to *Acanthochondria depressa* (T. Scott) and *Lepeophtheirus pectoralis* (Muller). *A. depressa* showed a preference for the ocular side of the body with its developing stages attached mainly to the second gill arch and the adults located in the posterior pocket of the branchial chamber. *L. pectoralis* was associated with the paired fins. Factors which could result in such localized distributions are discussed. (Author). 000847.

000386

Voss, E. W. Jr., Groberg, W. J. Jr., Fryer, J. L.

1980. Metabolism of coho salmon Ig. Catabolic rate of coho salmon tetrameric Ig in serum. Mol. Immunol. 17(4):445-452. (Dep. Microbiol. Univ. Illinois, Urbana, Ill. 61801.).

Catabolic rates of purified normal tetrameric Ig, anti-fluorescyl and anti-*Aeromonas salmonicida* antibodies were determined in vivo in 1-2 year old



coho salmon. An average catabolic decay rate of ~49 h at 12°C (ambient) was measured for purified normal Ig. Specifically purified antibodies showed rates of catabolism of 36-37 h at 12°C. The 7S monomer, derived by thiol reduction from normal tetrameric Ig, displayed the same decay rate as the parent polymer. Based on relative catabolic rate determinations at 6, 12, and 18°C, a temperature coefficient of 1.5 h per deg was derived. (Authors). 000845.

000387

Voss, E. W. Jr., Groberg, W. J. Jr., Fryer, J. L.

1978. Binding affinity of tetrameric coho salmon Ig anti-hapten antibodies. Immunochimistry 15:459-464. (Dep. Microbiol. Univ. Illinois, Urbana, Ill. 61801.).

Tetrameric Ig anti-fluorescyl antibody was purified from sera of immunized coho salmon by immunoadsorption and the ligand binding properties studied from a series of bleedings over a 120-day period. Purified antibody was assayed by fluorescence quenching and equilibrium dialysis for determination of the average intrinsic association constant ( $K_a$ ) and heterogeneity index ( $\alpha$ ). All antibody preparations showed an equilibrium constant of  $\sim 4.5 \times 10^8 \text{ M}^{-1}$  for the fluorescyl ligand, regardless of the time of bleeding after primary or secondary immunizations. Heterogeneity indices, derived from Sips plots, indicated relatively restricted heterogeneity in all purified antibody populations. The ligand binding results are discussed in terms of apparent restricted regulatory functions in salmon with respect to affinity maturation. (Authors). 000805.

000388

Warr, G. W., DeLuca, D., Griffin, B. R.

1979. Membrane immunoglobulin is present on thymic and splenic lymphocytes of the trout *Salmo gairdneri*. J. Immunol. 123(2):910-917. (Cancer Biol. Program, Natl. Cancer Inst. Frederick Cancer Res. Cent. Frederick, Md. 21701.).

Three rabbit antisera raised to trout IgM showed positive immunofluorescent reactions with lymphocytes of trout spleen and thymus. These antisera showed no detectable cross-reactivity with keyhole limpet hemocyanin, as determined by direct radioimmune precipitation and adsorption, and did not appear to react significantly with carbohydrate moieties on trout IgM, as determined by the failure of proteolytic digests of trout IgM to

inhibit in radioimmunoassay against intact trout IgM. Membrane immunoglobulin determinants were detectable on the membrane of both thymocytes and splenocytes with the lactoperoxidase-catalyzed iodination reaction. Radioimmunoassay of lysates of lymphocytes confirmed the association of immunoglobulin with trout thymocytes. By radioimmunoassay, lysates of thymic and splenic lymphocytes contained similar amounts of immunoglobulin, equivalent to approximately  $8 \times 10^4$  molecules of IgM per cell (calculated as the monomer  $\mu_2 \text{ L}_2$ ). (Authors). 000807.

000389

Watanabe, T., Tanaka, K., Tamura, O., Nakagawa, Y., Takahashi, K.

1980. Fine structure of the normal and virus-infected cells derived from the kidney of yamame, *Oncorhynchus masou*. Bull. Jpn. Soc. Sci. Fish. 46(4):401-406. (Sch. Fish. Sci. Kitasato Univ. Okirai, Sanriku-cho, Iwate 022-01, Japan.).

The normal and virus-infected cells of the cell line, YNK, derived from the kidney of yamame, *Oncorhynchus masou*, were studied at the ultrastructural level. The spindle-shaped YNK cells had an elongated nucleus with one or two nucleoli. Very prominent desmosomes were often seen between two neighboring cells. The cells had a well developed rough-surfaced endoplasmic reticulum (rER) and numerous mitochondria.

Many small vesicular invaginations, one of the characteristics of active pinocytotic cells, were seen adjacent to the cell membrane.

These properties suggest that YNK cells were derived from the epithelium of the distal tubules or the collecting tubules of yamame kidney.

YNK cells had at least 10 times the sensitivity of RTG-2 cells to the infectious pancreatic necrosis virus. The virus particles were found in the cisternae of the well developed rER. Those facts suggest that the main target cells of the virus are the epithelial cells with well developed rER, such as pancreatic acinar cells, renal tubular epithelial cells, and liver parenchymal cells.

YNK cells also had as much sensitivity against the infectious hematopoietic necrosis virus as that of RTG-2 cells. Numerous virus particles were found in intercellular spaces, and were matured by budding from the plasma membrane. (Authors). 000844.



000390

Watson, R. A., Dick, T. A.

1979. Metazoan parasites of whitefish *Coregonus clupeaformis* (Mitchill) and cisco *C. artedii* Lesueur from Southern Indian Lake, Manitoba. J. Fish Biol. 15(5):579-587. (Dep. Zool. Univ. Manitoba, Winnipeg, Man. Canada R3T 2N2.).

Metazoan parasite of whitefish *Coregonus clupeaformis* and cisco *C. artedii* from Southern Indian Lake, Manitoba were studied to reveal: species composition, differences with host age, sex, and location and season of capture. Whitefish hosted 19 species, 18 of which were also in cisco with generally lower intensity levels. Parasites exhibited definite patterns of abundance with host age and season, the primary causes being dietary and behavioral. No differences in parasite abundance existed between host sexes. Ranking of cisco parasites was significantly different between two sampling sites while whitefish parasites did not differ. Whitefish and cisco from sites 40 miles (64 km) apart had significantly different abundances of *Tetracotyle intermedia* but not *Triaenophorus crassus*. An increase in the abundance of copepod-vectorated cestodes with a concomitant decrease in abundance of amphipod-vectorated parasites is predicted after flooding and diversion. (Authors). 000941.

000391

Wedemeyer, G. A.

1980. Aquarium environment can be hazardous to fish's health. Pet Age 9(10):6,8-9. (U.S. Fish Wildl. Serv. Natl. Fish. Res. Cent. Bldg. 204 Naval Support Activity, Seattle, Wash. 98115.).

A generalized discussion of the relationships of host, pathogen, and the role of stress in the occurrence of fish diseases. Examples of stress factors affecting disease outbreaks are tabulated and described. Written for the hobbyist. (Ken Wolf). 000792.



# TOXICOLOGY

000392

Abo-Rady, M. D. K.

1979. The levels of heavy metals (Cd, Cu, Hg, Ni, Pb, Zn) in brook trouts from the River Leine in the area of Gottingen (West Germany). (Gehalt an Schwermetallen (Cd, Cu, Hg, Ni, Pb, Zn) in Bachforellen im Leine-Raum Gottingen.) Z. Lebensm.-Unters.-Forsch. 168:259-263. (Inst. Physische Geographie, Senckenberganlage 36, D-6000 Frankfurt/M. Fed. Rep. Germany.).

000909. (Paper in German)

000393

Alabaster, J. S., Shurben, D. G., Knowles, G.

1979. The effect of dissolved oxygen and salinity on the toxicity of ammonia to smolts of salmon, *Salmo salar* L. J. Fish Biol. 15(6):705-712. (Water Res. Cent. Stevenage Lab. Elder Way, Stevenage, Herts. SG1 1TH, England.).

000774.

000394

Alderson, R.

1979. The effect of ammonia on the growth of juvenile dover sole, *Solea solea* (L.) and turbot, *Scophthalmus maximus* (L.). Aquaculture 17(4):291-309. (Minist. Agric. Fish. Food, Fish Cultivation Unit, Port Erin, Isle of Man, Great Britain.).

000830.

000395

Arillo, A., Margiocco, C., Melodia, F.

1979. The gill sialic acid content as an index of environmental stress in rainbow trout, *Salmo gairdneri*, Richardson. J. Fish Biol. 15(4):405-410. (Inst. Zool. Univ. Genova, Italy.).

000905

000396

Barker, C. J., Rackham, B. D.

1979. The induction of sister-chromatid exchanges in cultured fish cells (*Ameioba splendens*) by carcinogenic mutagens. Mutat. Res. 68:381-387. (Min. Agric. Fish. Food, Dir. Fish. Res. Fish. Radiobiol. Lab. Lowestoft, Suffolk, Great Britain.).

000768.

000397

Batchelder, T. L., Alexander, H. C., McCarty, W. M.

1980. Acute fish toxicity of the versene family of chelating agents. Bull. Environ. Contam. Toxicol. 24(4):543-549. (Environ. Sci. Res. Lab. Dow Chem. U.S.A. Midland, Mich.).

000819

000398

Boddington, M. J., Mackenzie, B. A., deFreitas, A. S. W.

1979. A respirometer to measure the uptake efficiency of waterborne contaminants in fish. Ecotoxicol. Environ. Safety 3:383-393. (Div. Biol. Sci. Natl. Res. Council Canada, Ottawa K1A 0R6 Canada.).

000910.

000399

Cairns, T., Parfitt, C. H.

1980. Persistence and metabolism of TDE in California Clear Lake fish. Bull. Environ. Contam. Toxicol. 24(4):504-510. (Food Drug Admin. U.N. Plaza Fed. Off. Bldg. San Francisco, Calif. 94102.).

000817.

000400

Califano, R. J., O'Connor, J. M., Peters, L. S.

1980. Uptake, retention, and elimination of PCB (Aroclor 1254) by larval striped bass (*Morone saxatilis*). Bull. Environ. Contam. Toxicol. 24(3):467-472. (New York Univ. Med. Cent. Inst. Environ. Med. A. J. Lanza Lab. Tuxedo, N. Y. 10987.).

000772.

000401

Cheevaparanapivat, V., Menasveta, P.

1979. Total and organic mercury in marine fish of the Upper Gulf of Thailand. Bull. Environ. Contam. Toxicol. 23(3):291-299. (Inst. Environ. Res. Chulalongkorn Univ. Bangkok Thailand.).

000825.

000402

Coats, J. R., O'Donnell-Jeffery, N. L.

1979. Toxicity of four synthetic pyrethroid insecticides to rainbow trout. Bull. Environ. Contam. Toxicol. 23(1,2):250-255. (Dep. Environ. Biol. Univ. Guelph, Guelph, Ont. Canada N1G 2W1.).

000829.

000403

Colt, J., Mitchell, S., Tchobanoglous, G., Knight, A.

1979. The use and potential of aquatic species for wastewater treatment. Appendix B. The environmental requirements of fish. Calif. State Water Resour. Cont. Board Publ. no. 65. 240 pp. (Univ. California, Davis, Calif. 95616.).

000784.

000404

Daye, P. G., Garside, E. T.

1980. Development, survival, and structural alterations of embryos and alevins of Atlantic salmon, *Salmo salar* L. continuously exposed to alkaline levels of pH, from fertilization. Can. J. Zool. 58(3):369-377. (Dep. Biol. Dalhousie Univ. Halifax, N.S. Canada B3H 4J1.).

000831.

000405

Daye, P. G., Garside, E. T.

1980. Structural alterations in embryos and alevins of the Atlantic salmon, *Salmo salar* L. induced by continuous or short-term exposure to acidic levels of pH. Can. J. Zool. 58(1):27-43. (Dep. Biol. Dalhousie Univ. Halifax, N.S. Canada B3H 4J1.).

000804.

000406

Dodson, J. J., Mayfield, C. I.

1979. The dynamics and behavioral toxicology of Aqua-kleen (2,4-D butoxyethanol ester) as revealed by the modification of rheotropism in rainbow trout. Trans. Am. Fish. Soc. 108(6):632-640. (Dep. Biol. Univ. Waterloo, Waterloo, Ont. N2L 3G1, Canada.).

000836.

000407

Dwyer, W. P., Smith, C. E.

1979. Toxic effects in rainbow trout, *Salmo gairdneri*, exposed to treatment levels of potassium permanganate at various water temperatures. U.S. Fish Wildl. Serv. Developments in fish culture. Bozeman Inf. Leaflet. 9. 7 pp. (U.S. Fish Wildl. Serv. Fish Cult. Dev. Cent. 4050 Bridger Canyon Road, Bozeman, Mont. 59715.).

Triplicate lots of ten 5.5 g trout were exposed for 1 h to 5 or 7 mg per L  $\text{KMnO}_4$  at 4, 7, 10, 13, 16, or 19°C. One fish died at the 5 mg per L level (7°C), and at the 7 mg per L level fish died at increasing rates at temperatures from 13 to 19°C. Histologic examination showed mild to moderate edema and necrosis of gill epithelium at both dosage levels. The authors note that dosage levels exceeded



somewhat those recommended for parasite control. (Ken Wolf). 000795.

000408

Eisenberg, M., Mallman, R., Tubiash, H. S.

1980. Polychlorinated biphenyls in fish and shellfish on the Chesapeake Bay. Mar. Fish. Rev. 42(2):21-25. (Environ. Health Admin. Maryland Dep. Health Mental Hyg. Baltimore, Md. 21201.).

000898.

000409

Fandrei, G., Collins, H. L.

1979. Total residue chlorine: the effect of short-term exposure on the emerald shiner *Notropis atherinoides* (Rafinesque). Bull. Environ. Contam. Toxicol. 23(1,2):262-268. (Surface Ground Water, Minnesota Pollut. Control Agency, 1935 County Road B-2, Roseville, Minn. 55113.).

000822

000410

Fingerman, S. W.

1980. Differences in the effects of fuel oil, an oil dispersant, and three polychlorinated biphenyls on fin regeneration in the Gulf Coast killifish, *Fundulus grandis*. Bull. Environ. Contam. Toxicol. 25(2):234-240. (Dep. Biol. Tulane Univ. New Orleans, La. 70018.).

000871.

000411

Finlayson, B. J., Ashuckian, S. H.

1979. Safe zinc and copper levels from the Spring Creek drainage for steelhead trout in the upper Sacramento River, California. Calif. Fish Game 65(2):80-99. (California Dep. Fish Game, Water Pollut. Control Lab. 2005 Nimbus Road, Rancho Cordova, Calif. 95670.).

000851.

000412

Fisher, J. W., Harrah, C. B., Berry, W. O.

1980. Hydrazine: acute toxicity to bluegills and sublethal effects on dorsal light response and aggression. Trans. Am. Fish. Soc. 109(3):304-309. (Environ. Qual. Branch, Air Force Aerospace Med. Res. Lab. Wright-Patterson Air Force Base, Ohio 45433.).

000853.

000413

Fytizas, R.

1980. Toxicity of paraquat to three marine organisms. Bull. Environ. Contam. Toxicol. 25(2):283-288. (Benaki Phytopathol. Inst. Kiphissia-Athens, Greece.).

000873.

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Gelman, A., Herzberg, A.

1979. A field method to certify whether fish died from poisoning by acetylcholinesterase inhibition. Bamidgeh 31(1):18-20. (Fish. Technol. Unit, Dep. Fish. Minist. of Agric. Haifa, P.O.B. 699, Israel.).

000858.

000415

Goel, K. A., Garg, V.

1980. Histopathological changes produced in the liver and kidney of *Channa punctatus* after chronic exposure to 2,3',4-triaminoazobenzene. Bull. Environ. Contam. Toxicol. 25(2):330-334. (Postgrad. Dep. Zool. D.A.V. Coll. Muzaffargarh-251001, India.).

000877.

000416

Hedtke, S. F., Puglisi, F. A.

1980. Effects of waste oil on the survival and reproduction of the American flagfish, *Jordanella floridae*. Can. J. Fish. Aquat. Sci. 37(5):757-764. (U.S. Environ. Prot. Agency,

- Environ. Res. Lab\*sbld\*Duluth, 6201 Congdon Blvd. Duluth, Minn. 55804.).  
000869.
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Hiraoka, Y., Nakagawa, H., Murachi, S.  
1979. Blood properties of rainbow trout in acute hepatotoxicity by carbon tetrachloride. Bull. Jpn. Soc. Sci. Fish. 45(4):527-532. (Dep. Hyg. Sch. Med. Hiroshima Univ. Hiroshima, Japan.).  
000766.
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Hodson, P. V., Hilton, J. W., Blunt, B. R., Slinger, S. J.  
1980. Effects of dietary ascorbic acid on chronic lead toxicity to young rainbow trout (*Salmo gairdneri*). Can. J. Fish. Aquat. Sci. 37(2):170-176. (Dep. Fish. Oceans, Great Lakes Biolimnol. Lab. Canada Cent. Inland Waters, Burlington, Ont. L7R 4A6, Canada.).  
000769.
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Hodson, P. V., Spry, D. J., Blunt, B. R.  
1980. Effects on rainbow trout (*Salmo gairdneri*) of a chronic exposure to waterborne selenium. Can. J. Fish. Aquat. Sci. 37(2):233-240. (Dep. Fish. Oceans, Great Lakes Biolimnol. Lab. Canada Cent. Inland Waters, Burlington, Ont. L7R 4A6, Canada.).  
000770.
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Holman, W. F., Macek, K. J.  
1980. An aquatic safety assessment of linear alkylbenzene sulfonate (LAS): chronic effects on fathead minnows. Trans. Am. Fish. Soc. 109(1):122-131. (Environ. Safety Dep. Proctor Gamble Co. Ivorydale Tech. Cent. Cincinnati, Ohio 45217.).  
000777.
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Ito, Y., Murata, T.  
1980. Changes in glucose, protein contents and enzyme activities of serum in carp administered orally with PCB. Bull. Jpn. Soc. Sci. Fish. 46(4):465-468. (Women's Jr. Coll. Tokai Univ. Miyamae-cho, Shizuoka 420, Japan.).  
000897. (Paper in Japanese)
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Ito, Y., Nishimura, K., Murata, T.  
1980. Effects of PCB on lysosomes in the hepatopancreas of carp. Bull. Jpn. Soc. Sci. Fish. 46(4):469-472. (Women's Jr. Coll. Tokai Univ. Miyamae-cho, Shizuoka 420, Japan.).  
000896. (Paper in Japanese)
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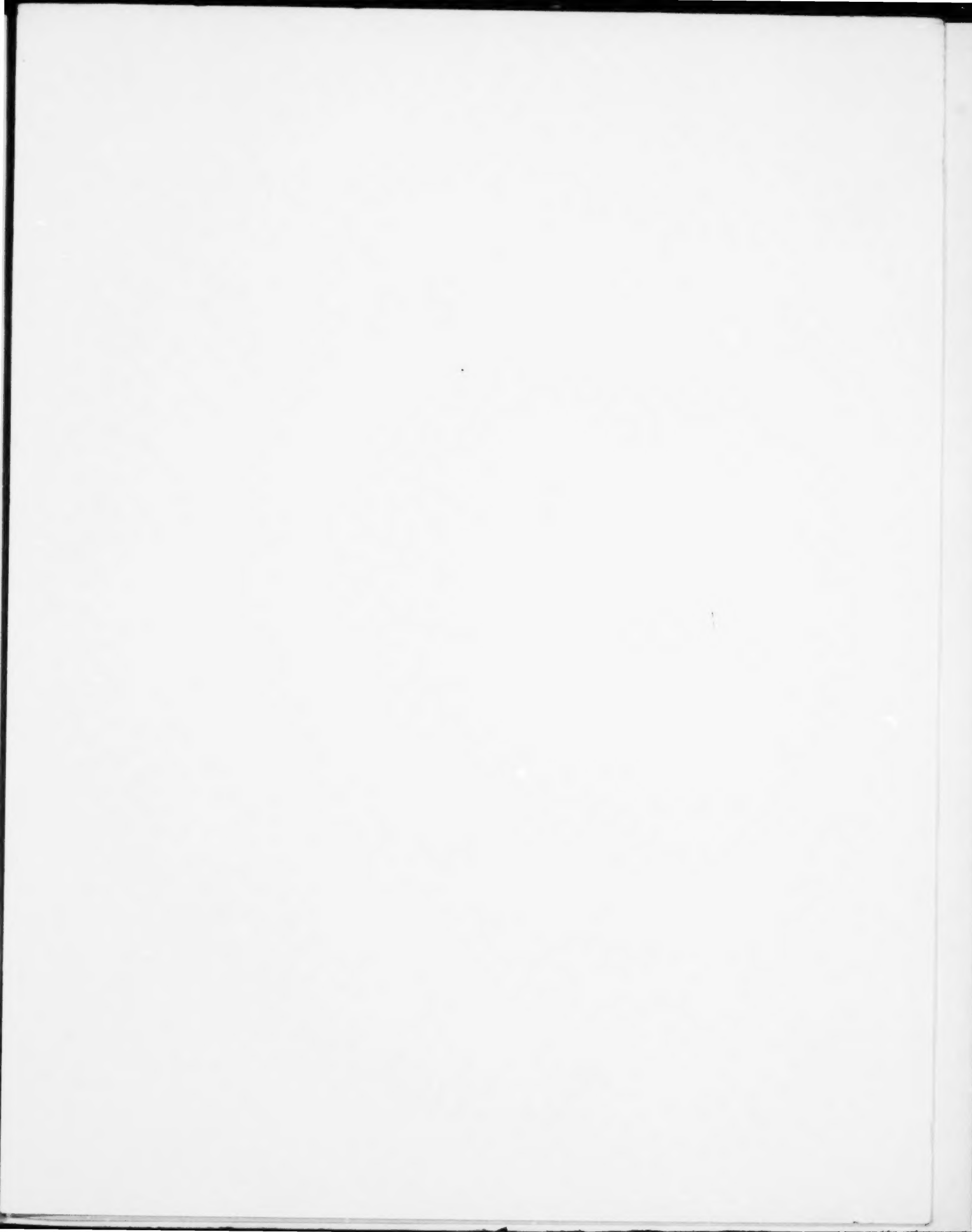
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### INFORMATION FOR AUTHORS

FISH HEALTH NEWS invites readers to submit short reports of their original work. Manuscripts should be sent to The Editor, FISH HEALTH NEWS, U.S. Fish and Wildlife Service, Route 3, Box 41, Kearneysville, West Virginia 25430. Manuscripts should be double-spaced, typewritten, and preferably not over 1500 words in length. Relevant graphics including sharp, glossy black and white photographs may be used. The reports are judged solely on their scientific merit and authors are responsible for accuracy and validity of the contents. Appearance of such reports in FISH HEALTH NEWS does not constitute publication, and authors are advised that they may submit regular manuscripts of such work for peer review and publication in established journals.

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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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# Fish Health News

A Service to the Field of Fish Health Research

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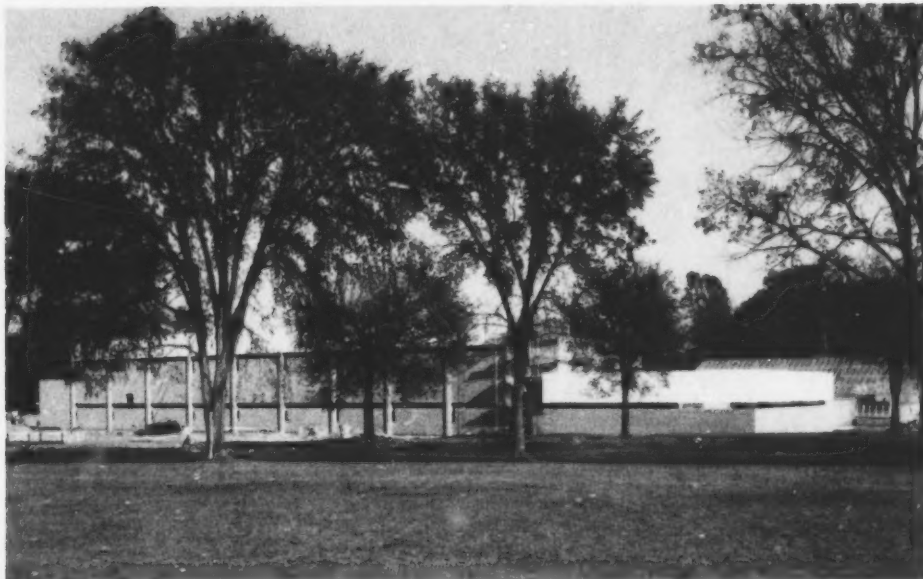
# FISH HEALTH NEWS



Editor Ken Wolf

Managing Editor Joyce A. Mann

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### INFORMATION FOR AUTHORS -----

cover 3

ERRATA: Due to computer software problems, several references in the Library Accessions are incomplete.

Item 000457 should read

Ahne, W. 1980. Fish diseases. Third Session EIFAC (European Inland Fisheries Advisory Commission of the FAO of the UN) and OIE (Office International des Epizooties) Cooperative Programme of Research on Aquaculture (COPRAQ) Fish Diseases, Institute for Zoology and Hydrobiology, Veterinary Faculty, Munich, 23-26 October 1979. Springer-Verlag, Berlin. 1980. 252 pp. \$49.80.

Items 506, 512, 536, 561, 568, 571, 578, and 610 should read

in J. L. Fryer, J. S. Rohovec, E. F. Pulford, R. E. Olson, D. P. Ransom, J. R. Winton, C. N. Lannan, R. P. Hedrick, and W. J. Groberg, eds. Proceedings from a conference on disease inspection and certification of fish and fish eggs. Oreg. State Univ. Sea Grant Coll. Program ORESU-W-79-001. 1979.



Furunculosis Control in Adult Atlantic Salmon  
with the Potentiated Sulfonamide Ro5-0037

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U.S. Fish and Wildlife Service  
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and

G. Maestrone  
Hoffmann-La Roche, Inc.  
340 Kingsland Street  
Nutley, New Jersey 07110

During 1977, furunculosis was diagnosed among adult Atlantic salmon (*Salmo salar*) that had been captured in the Penobscot and Union Rivers of Maine, and were being held at the Craig Brook (Maine) National Fish Hatchery (NFH) for the 4 to 5 months required for sexual maturation. It was feared the extended holding and the presence of furunculosis would pose a threat to survival of the fish and hence to egg production. The source of the causal organism has not been determined, but when the disease occurs, and if it is severe, the potential exists for reduction of an effective egg take.

In an effort to reduce mortality from furunculosis, returning salmon were injected with streptomycin, kanamycin, and chloramphenicol. The antibiotics were significantly therapeutic, but none have been registered by the U.S. Food and Drug Administration (FDA) for use on food fish. However, a potentiated sulfonamide, Ro5-0037 (a combination of five parts sulfamethoxine and one part ormetoprim), was effective for control of furunculosis in hatchery trout populations. Atlantic salmon held at the Craig Brook and Berkshire NFHs received a single intraperitoneal injection of Ro5-0037 (100 mg/kg).

Furunculosis occurred at both locations, but incidence at the Berkshire NFH was too low to evaluate the efficacy of the drug. At Craig Brook NFH, none of the 109 injected salmon died from the disease. In contrast, furunculosis claimed some of the

control fish; after 5 of 21 (24%) succumbed the remaining were injected and only one more death occurred before the time of spawning.

During 1980, the drug was tested again at both locations, but furunculosis occurred only at the Berkshire NFH. Sixty salmon received Ro5-0037 and 14 (23%) died from furunculosis; prior to spawning 8 of 19 (42%) untreated controls died of furunculosis.

Results from this limited study indicate potentiated sulfonamide is beneficial in reducing mortality from furunculosis in prespawning Atlantic salmon. The role of the drug may be prophylactic rather than therapeutic. Salmon may become infected after entering fresh water, or active disease may result from the stresses of migration and maturation that trigger latent infection. In either event, injection of Ro5-0037 helps reduce losses due to active furunculosis. The single injection probably has a relatively short effective time of persistence and, if salmon are additionally stressed, furunculosis might still occur. We postulate that this is the reason some injected salmon died during the holding period.

Follow-up observations at both hatcheries indicated Ro5-0037 injection of adults had no adverse effects on egg hatchability or fry viability. We are working to obtain FDA clearance of Ro5-0037 for use in adult Atlantic salmon.

## BOOK REVIEWS

Meng, H. J. 1980. On the outbreaks of saprolegniosis in Swiss Waters. (Ueber die Ursachen von Saprolegniosen in schweizerischen Gewässern). Ph.D. Thesis. Federal Technological Academy in Zurich, Switzerland. 105 pages.

This is a study on outbreaks of saprolegniosis among perch (*Perca fluviatilis*) and roach (*Rutilus rutilus*) in oligotrophic, mesotrophic, and eutrophic Swiss lakes.

"The present knowledge about the mechanisms of fungus attack on fish is still limited. Fungal zoospores in the water are responsible for the infection of fish. The spatial and temporal distribution of zoospores in Hallwilersee (Switzerland) was therefore investigated during one year using lake water filtrations. Maximum densities of zoospores were found in June in the littoral zone. The following relationship could be formulated, incorporating relevant data from another three lakes: while eutrophication increases, the mean and maximum density of zoospores decreases. Thus, the risk of fish fungus infection is smaller in eutrophic lakes than in mesotrophic or even oligotrophic lakes. Evidence for such a correlation was brought forth by means of systematic catches of fish in two representative

lakes. These catches were undertaken in order to elucidate the importance of saprolegniosis in fisheries.

A more detailed investigation of infested fish (perch and roach) yielded two basically different types of fungus attack." (Author.) The fungus was present on perch only in the immediate area of the wound. The fungus spread rapidly over the surface of the roach and penetrated deep into tissues. In perch, the incidence of saprolegniosis was in direct proportion to the number of spores in the water. In roach, only the D-type of *Saprolegnia* was present. Also, in perch there was a relationship between the age of fish and the incidence of infection. In 1-year-old perch 0.8% were affected while in 4-year-old perch 40% became diseased.

On the basis of electrophoresis of protein extracts, seven types of *Saprolegnia* were found. Three of these were identified with *S. ferax*, *S. parasitica*, and *S. delica*. On the basis of these studies, *S. delica* was separated from *S. diolina*.

--S. F. Snieszko

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Fisheries Research Institute of Shanghai, China, Editor. 1978. Artificial propagation of grass carp, silver carp, big head in China. Nursing fry culture of adult fish and technique about prevention and treatment of Fish's Diseases. Fisheries Research Institute of Shanghai, China. 34 pp.

As yet, comparatively little information is available on fish husbandry and fish health management practices in the Peoples Republic of China. Accordingly, our readers may find it interesting to learn that a bilingual (Chinese/English) booklet was published during 1978 by the Fisheries Research Institute of Shanghai, China. As indicated in the title, the information concerns only cyprinid species, but the text includes about eight

pages of text on diseases: bacterial gill disease, Ichthyophthiriasis, Asian tapeworm, enteritis, Trichodoniasis, and Lerneia. Treatments include sulfonamides, potassium permanganate, Dipterex, quicklime, mercurials, copper, and iron sulfates, and chlorine compounds.

Serious students of cyprinid husbandry--particularly polyculture--will find the booklet interesting.

--Ken Wolf



Ahne, W., editor. 1980. Fish Diseases.  
Third COPRAQ-Session. Springer-  
Verlag, Berlin, Heidelberg, New York.  
252 pp. Price \$49.80.

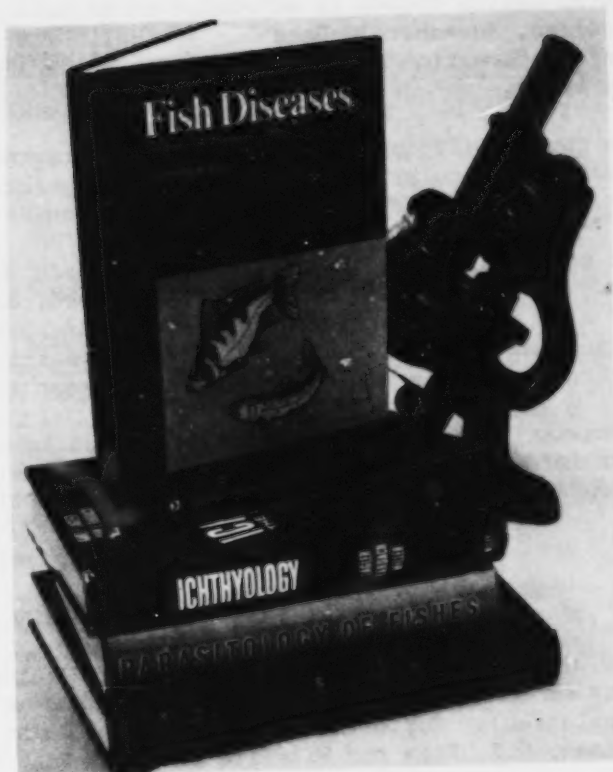
This book records contributions presented at the Third Session of the EIFAC (European Inland Fisheries Advisory Commission of the Food and Agriculture Organization of the United Nations) and OIE (Office International des Epizooties) Cooperative Program of Research on Aquaculture (COPRAQ) Fish Diseases. The session was held at the Institute for Zoology and Hydrobiology, Veterinary Faculty, Munich, on 23-26 October 1979.

Sponsorship of the session was by the Federal Ministry of Food Agriculture and Forest of the Federal Republic of Germany and by the Deutsche Forschungsgemeinschaft (DFG).

The EIFAC was represented by Prof. Dr. N. Fijan, Zagreb, Yugoslavia, and the OIE was represented by Prof. Dr. P. Ghittino, Turin, Italy and Dr. P. de Kinkelin, Thiverval-Grignon, France.

The Third COPRAQ Session brought to Munich an array of scientists from all over the world. Over 100 participants from more than 20 countries (most were from Europe, but Australia, Canada, Egypt, Israel, Kuwait, Nepal, and USA were also represented) discussed the major problems affecting the health of cultured fish. Thirty papers for the slide sessions and 13 papers for the poster session were submitted. Topics included were viral, bacterial, and parasitic diseases of fish, as well as emerging problems and approaches in aquaculture. (Author)

Combined, the distribution of papers and posters are categorized as: Bacterial 23, Viral 11, Parasite 5, and Miscellaneous 4. The individual papers are listed in the Library Accessions. (Ken Wolf).



## ITEMS OF INTEREST

### FISH HEALTH COURSE

A fish health course is scheduled to be held at Haywood Technical College, Clyde, North Carolina, November 30-December 4, 1981. The course is designed to give the trout farmer basic information needed to maintain a practical fish health management program for his operation.

The course will include: basic disease prevention, field recognition of disease problems, treatment calculations and applications, vaccines, drugs, how to handle fish kills, stress diets, handling stress, reconditioning poor quality water, and water chemistry.

The course instructor will be Dr. Bob Busch who is a board certified fish health inspector. He is presently Director of Research, Rangen Research Lab., Inc., Hagerman, Idaho, and also provides services for Zeigler Brothers, Inc., Gardners, Pennsylvania. The Rangen Lab is the largest and oldest commercial fish disease lab in the United States and works extensively with the commercial trout industry.

A registration fee of \$15.00, or less, will be charged (fee payable on November 30). For more information or to register contact: Charles W. Johnson, Fishery Training Specialist, Haywood Technical College, Clyde, N. C. 28721. Phone 704/672-2821.

\*\*\*

### TRANSLATION AVAILABLE

Some of you have already received copies of the English translation of the book *Tape-worms of the genus Triaenophorus, parasites and fishes* by B. I. Kuperman, 1973 (1981 translation). Copies are available on a first come, first served basis from: G. L. Hoffman, U.S. Fish and Wildlife Service, Fish Farming Experimental Station, Box 860, Stuttgart, Arkansas 72160 USA.

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### TRANSLATIONS: BOOKS OF SIGNIFICANCE

As noted in the first annual report of the Institute of Aquaculture, University of Stirling, a French translation of Prof. R. J. Roberts' book *Fish Pathology* has been published. In addition, German and Japanese translations have gone to press. The *Handbook of Salmon and Trout Diseases* by Prof. Roberts and C. J. Shepherd has been translated and published in Spanish.

## LIBRARY ACCESSIONS

000453

ACUIGRUP.

1980. Flavobacteriosis in coho salmon (*Oncorhynchus kisutch*). Pages 212-217 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Lab. Ictiopatol. Acuicultura Bioter, Apartado, 29008, Madrid 27, Spain.).

001165.

000454

ACUIGRUP.

1980. Trial vaccination of rainbow trout against *Aeromonas liquefaciens*. Pages 206-211 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Lab. Ictiopatol. Acuicultura Bioter, Apartado, 29008 Madrid 27, Spain.).

001164.

000455

Adair, B. M., Ferguson, H. W.

1981. Isolation of infectious pancreatic necrosis (IPN) virus from non-salmonid fish. J. Fish Dis. 4(1):69-76. (Vet. Res. Labs. Stormont, Belfast BT4 3SD, Northern Ireland.).

The isolation and characterization of infectious pancreatic necrosis (IPN) virus from a goldfish, discus fish and bream is described. The fish from which the isolates were recovered showed no pathological signs of IPN. All three virus isolates were neutralized by antiserum to IPN, strain Ab, but not by antiserum to the Sp or VR 299 strains. They were morphologically identical to IPN virus in negative stain electron microscopy, grew in the cytoplasm of BF-2 cells, as shown by immunofluorescence and, like IPNV, were stable to heating, lipid solvents and acid pH. (Authors). 001127.

000456

Ahne, W.

1980. Spring viremia of carp (SVC): studies on immunization of carp. Page 28 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Inst. Zool. Hydrobiol. Univ. Munich, 8000 Munich, Fed. Rep. Germany.).

One- and three-year-old carp (*Cyprinus carpio*) were infected by water route with spring viremia of carp virus (SVC). Infected carp kept at 10 ( $\pm 1$ )°C, 15 ( $\pm 1$ )°C, and 20 ( $\pm 1$ )°C developed neutralizing antibodies 8, 7, and 5 weeks after infection. Circulating antibodies persisted during the period of experiment (17 weeks) and carp showed a protective immunity to a challenge (IP) with SVC virus.

Carp immunized by injection of SVC virus developed neutralizing antibodies within 28 days at 20°C. Subsequent lowering of temperature of water (10°C) and challenge with SVC virus did not influence the immune status of the carp. (Author). (Abstract only). 001136.

000457

Ahne, W.

1980. Fish diseases. Third Session EIFAC (European Inland Fisheries Advisory Commission of the FAO of the UN) and OIE (Office International des Epizooties) Cooperative Programme of Research on Aquaculture (COPRAQ) Fish Diseases, Institute for Zoology and Hydrobiology, Veterinary Faculty, Munich, 23-26 October Inst. Zool. Hydrobiol. Univ. Munich, Fachbereich Tiermedi. (Inst. Zool. Hydrobiol. Univ. Munich, Fachbereich Tiermedizin, Kaulbachstrasse 37, 8000 Munich 22, Fed. Rep. Germany.).

001131.

000458

Ahne, W.

1978. Isolation and characterization of infectious pancreatic necrosis virus from pike (*Esox*

*lucius*). Brief report. Arch. Virol. 58(1):65-69. (Inst. Zool. Hydrobiol. Vet. Fac. Univ. Munich, Kaulbachstrasse 37, D-8000 Munich 22, Fed. Rep. Germany.).

A nonenveloped icosahedral virus measuring 60 ( $\pm 5$ ) nm in diameter has been isolated from pike fry (*Esox lucius*). The isolate is stable to heat, lipid solvent and acid. Iododeoxyuridine has no effect on its replication. Serologically, the virus is related to the major European strains of infectious pancreatic necrosis virus (IPN) Sp and Ab.

The isolate is neutralized by normal trout serum and is not pathogenic for trout fry or for young pike. A line of CHSE-214 cells persistently infected with the isolate was established and has been passed 30 times. (Author). 001081

000459

Ahne, W.

1980. Experimental infection of pike (*Esox lucius*) with Egtved virus. (Experimentelle Egtvedvirusinfektion beim Hecht (*Esox lucius* L.)). Tieraerztl. Umsch. 4(1):225-229. (Inst. Zool. Hydrobiol. 8 Munchen 22, Kaulbachstr. 37, Fed. Rep. Germany.).

Pikes (fry, fingerlings) are susceptible to an infection with Egtved virus via water, food, and by injection of virus. Infected fish showed extensive hemorrhages in skin and muscle 3-4 days after infection. One-hundred per cent mortalities occurred and the virus could be reisolated from a variety of organs. (Author). 000985. (Paper in German)

000460

Ahne, W.

1980. IPN virus persistently infected fish cells: studies on growth rates of the cells and on the replication of Egtved virus. (IPN-Virus permanent infizierte Fischzellen: Untersuchungen über Zellvermehrung und Egtvedvirusreplikation.) Zentralbl. Bakteriolog. Hyg. 264:304-307. (Inst. Zool. Hydrobiol. 8 Munchen 22, Kaulbachstr. 37, Fed. Rep. Germany.).

CHSE-214 cells and IPN virus persistently infected CHSE cells showed no differences in morphology and in growth rates. Egtved virus was replicated in IPN virus persistently infected cells but virus multiplication was about 90% suppressed

compared with the virus yield of standard CHSE cells. (Author). 000984. (Paper in German)

000461

Ahne, W., Held, C.

1980. Investigations of the virucidal activity of Actomar K<sub>30</sub> on pathogenic viruses of fish. (Untersuchungen über die viruzide Wirkung von Actomar K<sub>30</sub> auf fischpathogene viren.) Tieraerztl. Umsch. 35:308-318. (Inst. Zool. Hydrobiol. Univ. Munchen, Kaulbachstr. 37, D-8000 Munchen 22, Fed. Rep. Germany.).

The virucidal effect of active iodine (Actomar K<sub>30</sub>) on three rhabdoviruses pathogenic to fish (Egtved virus, PFR, RVC) and a naked virus (IPN) closely related to the reoviridae was studied. A reliable virucidal effect, under practical conditions, was obtained at concentrations of 100-200 ppm. (Authors). 000994. (Paper in German)

000462

Ahne, W., Weiler, A.

1980. Studies on the susceptibility of fish cell cultures to fish pathogenic viruses. (Untersuchungen zur Virusempfänglichkeit von Fischzellkulturen.) Dtsch. Tieraerztl. Wochenschr. 87:56-59. (Inst. Zool. Hydrobiol. 8 Munchen 22, Kaulbachstr. 37, Fed. Rep. Germany.).

Fish cell cultures (CHSE, FHM, PG, RF, RTG-2) showed an age dependent susceptibility to Egtved virus, IPN virus (strain Sp) and RVC. In most of the cultures titers of viruses decreased with an increase of age of the cells. Infectious pancreatic necrosis virus multiplied in FHM cells without visible cytopathic effect and RF-cells (rainbow trout gonads) were not susceptible to RVC. (Authors). 000983. (Paper in German)

000463

Aldrin, J. F., Messenger, J. L., Mevel, M.

1979. A study of transport stress in juvenile coho salmon (*Oncorhynchus kisutch*). (Essai sur le stress de transport chez le saumon coho juvenile (*Oncorhynchus kisutch*).) Aquaculture 17(4):279-289. (Minist. Agric. Direction de la Qualite, Lab. Natl. Pathol. Anim. Aquat. B. P. 337, 29273 Brest Cedex, France.).

The mean values of eight blood parameters in a population of freshwater juvenile coho salmon



were compared before and after transportation. All parameters were affected immediately following 3 h transportation with final hypoxia: hematocrit, hemoglobin, total plasma protein, total cholesterol, and  $\text{Na}^+$  increased,  $\text{Cl}^-$  and  $\text{K}^+$  decreased. The mean glucose value was not greatly modified; however, some individuals showed very high values, while others showed very low values. This peculiar finding may be due to the low nutritional level of the population (hypoglycemic individuals probably having exhausted their glycogen stores).

After 8 days the parameters had returned to their initial levels, with the exception of  $\text{Na}^+$  and cholesterol. Identical results were found 1 month later.

Following a formalin-malachite green bath treatment, parameter modification resembled that observed after transportation except for  $\text{Na}^+$  and  $\text{K}^+$ , which remained relatively unchanged. (Authors). 000960. (Paper in French)

000464

Alexander, J. B.

1980. Precipitins in the serum of the Atlantic salmon. Dev. Comp. Immunol. 4(4):641-651. (Dep. Biol. Univ. Salford, Gardner St. Annex, Salford, M6 6WZ, U. K.).

Sera were collected from Atlantic salmon from rivers and estuaries in Northwest England; Northern Ireland, Wales and Southwest England in the years 1966 to 1975, during an outbreak of ulcerative dermal necrosis (UDN), and examined against extracts of diseased tissue (DTE) and amylopectin (Ap) by gel diffusion and single radial immunodiffusion (SRID). From 1966 to 1970 the percentage of salmon from fresh water containing precipitins to DTE increased to almost 100% and remained at that level. The majority of sera gave a precipitin line with Ap. In SRID with 1% Ap in the agar, two precipitin rings occurred: an outer diffuse and an inner, dense ring. The dominant precipitin reacting with DTE is not an immunoglobulin but an antibody-mimetic protein called  $\alpha$ -precipitin. (Authors). 001023.

000465

Andrews, C., Chubb, J. C., Coles, T., Dearsley, A.

1981. The occurrence of *Bothriocephalus acheilognathi* Yamaguti, 1934 (*B. gowkongensis*) (Cestoda: Pseudophyllidae) in the British Isles. J. Fish Dis. 4(1):89-93. (Yorkshire Water Au-

thority (Sci. Serv.), Olympia House, Gelderd Road, Leeds LS12 6DD, Yorkshire, England.).

Routine health checks revealed the presence of the Asian tapeworm at three different facilities. This is the first report of this parasite in the British Isles. Control measures were recommended and probable eradication was effected at one facility. The parasite, however, may have escaped to fish in natural waters (Ken Wolf). 001130.

000466

Aoki, T., Jo, Y., Egusa, S.

1980. Frequent occurrence of drug resistant bacteria in ayu (*Plecoglossus altivelis*) culture. Fish Pathol. 15(1):1-6. (Dep. Fish. Fac. Agric. Miyazaki Univ. Miyazaki, Japan.).

Chloramphenicol (CM)- and tetracycline (TC)-resistant bacteria which could grow on heart infusion agar containing 6.2 mcg per ml of CM or TC, respectively, were isolated with high frequencies from the intestinal tracts of cultured ayu (*Plecoglossus altivelis*) and the water of ayu culturing ponds in Tokushima Pref. CM- and TC-resistant bacteria were not isolated from the intestinal tracts of wild ayu collected from the river Nakagawa in Tokushima Pref. The principal drug resistant bacteria isolated from the intestinal tracts were *Aeromonas hydrophila* and *Vibrio anguillarum*. Drug resistant *Pseudomonas*, *Enterobacter aerogenes*, *E. cloacae*, *Escherichia coli*, *Hafnia*, *Salmonella arizonae* and other unidentified *Enterobacteriaceae* were occasionally found. Drug resistant bacteria isolated from the water of ponds were common to those from the intestinal tracts. However, drug resistant *E. coli*, *Pseudomonas* and *V. anguillarum* were not isolated from the water. All drug resistant *V. anguillarum* strains carried R plasmids. R plasmids were detected in a part of the *Hafnia*, *E. cloacae*, *A. hydrophila*, unidentified *Enterobacteriaceae* and *E. aerogenes* strains. The drug resistance markers present in the R plasmid bearing strains were in most cases sulfonamides streptomycin CM and TC. (Authors). 001046. (Paper in Japanese)

000467

Aoki, T., Kitao, T., Kawano, K.

1981. Changes in drug resistance of *Vibrio anguillarum* in cultured ayu, *Plecoglossus altivelis* Temminck and Schlegel, in Japan. J. Fish Dis. 4(3):223-230. (Dep. Fish. Fac. Agric. Miyazaki Univ. Miyazaki 880, Japan.).

Two-hundred-and-fifty-nine strains of *Vibrio anguillarum* isolated from diseased cultured ayu, *Ple-*



*coglossus altivelis*, in various districts of Japan from 1974 to 1977 were studied for their sensitivity to 12 different chemotherapeutic agents: chloramphenicol (CM), tetracycline (TC), streptomycin (SM), kanamycin (KM), aminobenzyl penicillin (ABP), colistin (CL), nalidixic acid (NA), oxolinic acid (OA), piromidic acid (PA), furazolidone (NF), sulphamonomethoxine (SA), and trimethoprim (TMP). One-hundred-and-thirty-four of the strains were additionally tested for sensitivity to O/129 (2, 4-diamino-6, 7-diisopropyl pteridine) and ormetoprim (OMP). All strains were susceptible to SM, KM, and ABP and also highly sensitive to CL. A correlation of resistance was found among the chemically-related drugs NA, OA, and PA, and TMP, OMP, and O/129. Nine strains were sensitive to all the drugs tested. The remaining 250 strains were resistant to various combinations of six drugs (CM, TC, NA, NF, SA, and TMP). In particular, strains resistant to NA and NF (20.1%) to CM, TC, SA, NA, and NF (29.7%), and to all six drugs (28.2%) were frequently detected. NA or NF resistant strains have increased since 1974 and TMP resistant strains have increased since 1976. Transferable R plasmids were detected in 165 out of 250 resistant strains. The most common type of R plasmid determined resistance to CM, TC, and SA. These multiple drug resistant strains with transferable R plasmids were isolated from many different districts. (Authors). 001101.

000468

Austin, B.

1980. Characterization of the causal agents of bacterial kidney disease. Pages 147-153 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Minist. Agric. Fish. Food, Dir. Fish. Res. Fish Dis. Lab. Weymouth, Dorset DT4 8UB, England.).

001155.

000469

Barham, W. T., Smit, G. L., Schoonbee, H. J.

1980. The effect of bacterial infection on erythrocyte fragility and sedimentation rate of rainbow trout, *Salmo gairdneri* Richardson. J. Fish Biol. 16(2):177-180. (Dep. Zool. Rand Afrikaans Univ. P. O. Box 524, Johannesburg 2000, South Africa.).

Osmotic fragilities and erythrocyte sedimentation rates (ESR) were measured in healthy, diseased, treated, and recovered trout, *Salmo gaird-*

*neri*. Bacterial infection with *Aeromonas* and *Streptococcus* resulted in more fragile erythrocytes and raised ESR values. Treatment with antibacterial agents improved the values of both parameters. Possible reasons for such changes are discussed. Caution in the use of apparently healthy fish for the unqualified interpretation of hematological results is expressed. (Authors). 000972.

000470

Baudin Laurencin, F., Tangtrongpiros, J.

1980. Some results of vaccination against vibriosis in Brittany. Pages 60-68 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Lab. Natl. Pathol. Anim. Aquat. Minist. Agric. Dir. Qualite, Serv. Vet. COB-BP 337, 29273 Brest Cedex, France.).

001141.

000471

Baudouy, A. M., Danton, M., Merle, G.

1980. Experimental infection of susceptible carp fingerlings with spring viremia of carp virus, under wintering environmental conditions. Pages 23-27 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Lab. Cent. Rech. Vet. 22, Rue Pierre-Curie, B. P. 67, 94703 Maisons Alfort Cedex, France.).

The rhabdoviral infection of carp has been called spring viremia (SVC) because of its spring burst. Therefore, the aim of the present work was to investigate the infection processes occurring during winter in order to bring some light to the triggering of the disease. (Authors). 001135.

000472

Black, G. A., Lankester, M. W.

1980. Migration and development of swim-bladder nematodes, *Cystidicola* spp. (Habronematodea), in their definitive hosts. Can. J. Zool. 58(11):1997-2005. (Dep. Biol. Lakehead Univ. Thunder Bay, Ont. Canada P7B 5E1.).

Third-stage larvae of *Cystidicola cristivomeri* White, 1941, and *C. farionis* Fischer, 1798, migrated directly via the pneumatic duct to the swim bladder of lake trout, *Salvelinus namaycush*, and rainbow trout, *Salmo gairdneri*, respectively. Larvae reached the swim bladder as early as 16 h

after fish were infected using a stomach tube. At 4-10°C, mature male and female *C. cristivomeri* and *C. farionis* were first recovered 67 and 210 days, and 112 and 235 days, respectively, after infection. *Cystidicola cristivomeri* is probably long-lived; there was no evidence that any died in lake trout infected for up to 600 days.

Large numbers of third-stage cystidicolid larvae accumulated without maturing in the swim bladder of naturally infected lake whitefish, *Coregonus clupeaformis*, from Lake Nipigon, northwestern Ontario. When given to rainbow trout, these larvae matured and the adult nematodes were identical to *C. farionis*. These results suggest that the swim-bladder nematode that matures in lake whitefish is a distinct species. (Authors). 000998

000473

Brandal, P. O., Egidius, E.

1980. Treatment of salmon lice (*Lepeophtheirus salmonis* Kroyer) with Neguvon. Page 248 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Inst. Mar. Res. C. Sundts gt. 37, 5000 Bergen, Norway.).

(Abstract only). See also FHN 9(3), 1980 for abstract of published paper. 001171.

000474

Bucke, D.

1980. Experimental and naturally occurring furunculosis in various fish species: a comparative study. Pages 82-86 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Minist. Agric. Fish. Food, Dir. Fish. Res. Fish Dis. Lab. Weymouth DT4 8UB, Dorset, England.).

001144.

000475

Bullock, A. M., Roberts, R. J.

1981. Sunburn lesions in salmonid fry: a clinical and histological report. J. Fish Dis. 4(3):271-275. (Dunstaffnage Mar. Res. Lab. P.O. Box 3, Oban, Argyll, Scotland.).

Two very carefully reported case histories of sunburn, presumptively related to high insolation, among a rainbow trout and an Atlantic salmon. Mortality subsided only among fish that were provided with shade. Lesions are described and illus-

trated. The causal agent is considered to be in the short range (280-320 nm) ultraviolet, the so-called UV-B. (Ken Wolf). 001106.

000476

Burke, J. A., Mulcahy, D.

1980. Plaquing procedure for infectious hematopoietic necrosis virus. Appl. Environ. Microbiol. 39(4):872-876. (Natl. Fish. Res. Cent. Naval Support Activity, Seattle, Wash. 98115.).

A single overlay plaque assay was designed and evaluated for infectious hematopoietic necrosis virus. Epithelioma papillosum carpio cells were grown in normal atmosphere with tris(hydroxymethyl)aminomethane or HEPES (N-2-hydroxyethylpiperazine-N'-2-ethanesulfonic acid)-buffered media. Plaques were larger and formed more quickly on 1- to 3-day-old cell monolayers than on older monolayers. Cell culture medium with a 10% addition of fetal calf serum (MEM 10) or without serum (MEM 0) were the most efficient virus diluents. Dilution with phosphate-buffered saline, saline, normal broth, or deionized water reduced plaque numbers. Variations in the pH (7.0 to 8.0) of a MEM 0 diluent did not affect plaque numbers. Increasing the volume of viral inoculum above 0.15 ml (15- by 60-mm plate) decreased plaquing efficiency. Significantly more plaques occurred under gum tragacanth and methylcellulose than under agar or agarose overlays. Varying the pH (6.8 to 7.4) of methylcellulose overlays did not significantly change plaque numbers. More plaques formed under the thicker overlays of both methylcellulose and gum tragacanth. Tris(hydroxymethyl)aminomethane and HEPES performed equally well, buffering either medium or overlay. Plaque numbers were reduced when cells were rinsed after virus adsorption or less than 1 h was allowed for adsorption. Variation in adsorption time between 60 and 180 min did not change plaque numbers. The mean plaque formation time was 7 days at 16°C. The viral dose response was linear when the standardized assay was used. (Authors). 001024.

000477

Burn, P. R.

1980. Density dependent regulation of a fish trematode population. J. Parasitol. 66(1):173-174. (Osborn Lab. Mar. Sci. New York Aquarium, N. Y. Zool. Soc. Boardwalk at W. 8th St. Brooklyn, N. Y. 11224.).

Sixteen Philippine flashlight fish were necropsied and gallbladders of 15 had but a single pair of *Deretrema* parasites. The finding was interpreted as density-dependent parasite regulation. (Ken Wolf). 000971.

000478

Bylund, G., Sumari, O.

1981. Laboratory tests with Droncit against diplostomiasis in rainbow trout, *Salmo gairdneri* Richardson. J. Fish Dis. 4(3):259-264. (Inst. Parasitol. Abo Akademi, SF-20500 Abo 50, Finland.).

Droncit, an isoquinoline-pyrazine derivative, was used at a mean rate of 330 mg per kg fish per day of medication. One group of experimentally infested rainbow trout (35-340 g) received the drug for 6 consecutive days. A second group was treated every 4th day for a month. Control fish received non-medicated feed, and all fish were necropsied 15-180 days after the last medication. The medicated ration was readily accepted by the fish, and it had a marked degenerative effect on larvae within the lens. In related work, the drug also showed marked prophylaxis of metacercariae, i.e. inhibition of migration. The report is illustrated and tabular results are included. (Ken Wolf). 001104.

000479

Bylund, G., Valtonen, E. T., Niemela, E.

1980. Observations on epidermal papillomata in wild and cultured Atlantic salmon *Salmo salar* L. in Finland. J. Fish Dis. 3(6):525-528. (Inst. Parasitol. Abo Akademi, Abo, Finland.).

Selectively for young Atlantic salmon (age class 1 and 2) but not appearing in other propagated species of salmonids, epidermal papillomatosis has occurred regularly in the Montta hatchery since 1968. Small transparent patches appear on the skin late in July, develop into papillomas then slough beginning in late October as temperatures drop to 1-3°C. The most serious outbreaks occurred during 1978-79 when 80-90% of the fish in some tanks were affected. In 1978, approximately 50% of the affected fish died, most likely as a result of bacterial invasion of ulcerated sites where tumors had sloughed. The 1979 outbreak was noteworthy in that it was confined to two tanks of fish that had not received weekly treatments with 2-3% NaCl and 1:4000 formalin (duration not specified). Papillomatosis also occurs at about a 1% incidence among age class 3 wild salmon in an isolated area

of Finland. Macro and micrographs of the lesions are provided. (Ken Wolf). 001003.

000480

Canning, E. U., Olson, A. C. Jr.

1980. *Nosema lepocreadii* sp. n. a parasite of *Lepocreadium manteri* (Digenea: Lepocreadiidae) from the gut of the California grunion, *Leuresthes tenuis*. J. Parasitol. 66(1):154-159. (Dep. Zool. Imperial Coll. London, SW7 2AZ, England.).

*Nosema lepocreadii* sp. n. is described from adult flukes *Lepocreadium manteri* Olson 1978 from California grunion. The microsporidia are parasitic in cells of the vitelline system. The arrangement of nuclei in diplokarya and the disporoblastic sporogony are characteristic of the genus *Nosema* Naegeli 1857. Schizonts with homogeneous cytoplasm and vesicular nuclei can be distinguished from sporonts that have banded cytoplasm and compact nuclei. Chain formation of schizonts or sporonts is common. Spores are  $3.5 \times 1.5 \mu\text{m}$  when fresh. (Authors). 000973.

000481

Chart, H., Munn, C. B.

1980. Experimental vibriosis in the eel (*Anguilla anguilla*). Pages 39-44 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Sch. Environ. Sci. Plymouth Polytech. Plymouth, PL4 8AA, England.).

001138.

000482

Chien, C. H., Miyazaki, T., Kubota, S. S.

1979. Branchiomycosis of the reared Japanese eel in Taiwan. Fish Pathol. 13(4):179-182. (Dep. Fish. Fac. Fish. Mie Univ. Edobashi, Tsu, Mie, Japan.).

Branchiomycosis broke out among the reared Japanese eel (*Anguilla japonica*) in summer 1977 in Taiwan. The causative fungus had characteristics similar to *B. sanguinis*.

Fungal hyphae grew in the filamental arteries and lamella capillaries in the gills. Intrahyphal spore-formation was observed in the well grown hyphae. The affected lamellae showed severe circulatory disturbance as dilation of capillaries, hemorrhages and fibrin deposition. Metastatic lesions

with hyphae and spores were observed in the epicardium, but the spleen only spores. (Authors). 000964. (Paper in Japanese)

000483

Chilmonczyk, S.

1980. Some aspects of trout gill structure in relation to Egtved virus infection and defense mechanisms. Pages 18-22 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Lab. Ichthyopathol. Inst. Natl. Rech. Agron. 78850 Thiverval-Grignon, France.).

001134

000484

Cleator, G. M., Burney, L. A.

1980. The hemagglutinating properties of infectious pancreatic necrosis virus. Arch. Virol. 63(2):81-85. (Dep. Bacteriol. Virol. Univ. Manchester, Stopford Bldg. Oxford Road, Manchester M 13 9 PT, England.).

The hemagglutinating properties of infectious pancreatic necrosis virus have been investigated. Erythrocytes from a wide range of animals were used in these tests but only cells derived from mice (Balb/c and Manchester strain) gave reproducible hemagglutination.

The tests were carried out at various temperatures but hemagglutination only occurred at 4 and 22°C. The hemagglutination was pH dependent with an optimum being between pH 5.75 and 6.0.

Variable results were obtained at the same pH values with erythrocytes derived from rats (Sprague Dawley) but the reaction in this case appeared to be related to individual batches of erythrocytes. (Authors). 001080.

000485

Cloutman, D. G.

1980. Two new species of *Dactylogyrus* (Monogenea: Dactylogyridae) from *Notropis scabriceps* (Cope) and *N. scepticus* (Jordan and Gilbert) (Pisces: Cyprinidae). J. Parasitol. 66(1):160-161. (Duke Power Co. Environ. Lab. Route 4, Box 531, Huntersville, N. C. 28078.).

*Dactylogyrus newensis* sp. n. is described from the New River shiner, *Notropis scabriceps* (Cope), and *D. sceptici* sp. n. from the sandbar shiner, *N.*

*scepticus* (Jordan and Gilbert). *Dactylogyrus newensis* differs from its closest apparent relative, *D. percobromus* Monaco and Mizelle, most notably by having a sharp bend near the distal end of the cirrus. *Dactylogyrus sceptici* most closely resembles *D. banghami* Mizelle and Donahue, but differs by possessing a much longer and less arched cirrus. (Author). 000976.

000486

Cone, D. K.

1980. The monogenea of some freshwater fishes in New Brunswick, Canada. J. Parasitol. 66(1):178-180. (Dep. Biol. Univ. New Brunswick, Fredericton, N. B. E3B 5A3, Canada.).

A note about a 2-month-long survey in which 21 species of monogenetic trematodes were found in a survey of 13 species of host fishes. (Ken Wolf). 000969.

000487

Conroy, D. A., Vasquez, C., Morales, J.

1980. The use of nifurpirinol in the control of chilodonelliasis and ichthyophthiriasis in species of Colombian cold water fish. J. Fish Dis. 3(6):531-532. (Sect. Ictiopatol. Fac. Ciencias Vet. Univ. Central Venezuela, Apartado de Correos No. 4563, Maracay 2 KO, Edo. Aragua, Venezuela.).

Samples of 25 characin and 25 pygidiid fishes in water of pH 7.5, 12-13°C and 15 ppm total hardness were successfully treated for *Chilodonella* and *Ichthyophthirius multifiliis*. Effective treatment consisted of 2 ppm for 19 h or 0.07 ppm as a continuous bath on three occasions at 48 h intervals. Mortality among untreated lots ranged from 84-100%. Treatment with 5 ppm for 5 min was ineffective. (Ken Wolf). 001005.

000488

Copland, J. W.

1981. The occurrence and distribution of *Myxidium giardi* Cepede, 1906 in wild and cultured European eels, *Anguilla anguilla* L. in England. J. Fish Dis. 4(3):231-242. (Unit of Aquatic Pathobiol. Univ. Stirling, Stirling, Scotland.).

*Myxidium giardi* was found in wild and cultured eels. The prevalence rate in elvers was 77% in the River Torridge (Devon), 80% in the River Parrett



(Somerset) and 90% in the River Ouse (Yorkshire). Adult eels from the River Ouse had a prevalence rate of 53%. Cultured fingerlings and adults had a prevalence rate of 60% and 7%, respectively. There was an apparent age related pattern in the organ location of the histozoic trophozoite: an initially high prevalence of kidney trophozoites which gradually decreased with age; in the gills of elvers there was a low prevalence of histozoic trophozoites which increased in the adult stage. Histozoic trophozoites were also found in the stomach and intestine of elvers and fingerlings. A qualitative estimate of trophozoite numbers in each organ of elvers is given. The coelozoic trophozoite of *M. giardi* in the gall bladder of elvers and fingerlings is also described for the first time. (Author). 001102

000489

Csaba, G., Kormendy, B., Bekesi, L.

1980. Examination of the CE agent. Page 126 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Cent. Vet. Inst. 1581 Budapest, Pf. 2, Hungary.).

Over the last four years 15 bacterial isolates of CE agent were obtained in our examinations from ulcers of carp from various Hungarian fish farms. Successful isolations were primarily carried out from the peripheral area of ulcers on blood agar. Then liquid medium cultures after 72 h of incubation were used for experimental inoculations into the scarified skin of carp using injection needles for this purpose. Infected carp showed characteristic dermatitis 5-6 days following scarification. There were either ulcers, sometimes even in small groups along the line of the scarification, or small sized papulas with hyperemic margins on the sites of needle pricking, and the central area of the latter was often necrotic. Similar results were also obtained following experimental infection into the damaged fins of carp, which then often broke and came off. The pathogenic agent was easily reisolated from the lesions. The 15 isolates had almost identical features in the bacteriological procedures. According to our examination these CE agents seemed to belong to the *Aeromonas* genus of Vibrionaceae. More exactly, their bacteriological properties mainly corresponded to those of *Aeromonas salmonicida* with some small differences from its subspecies. (Authors). (Abstract only). 001152

000490

Current, W. L.

1979. *Henneguya adiposa* Minchew (Myxosporida) in the channel catfish: ultrastructure of the plasmodium wall and sporogenesis. J. Protozool. 26(2):209-217. (Dep. Zool. Entomol. Auburn Univ. Auburn, Ala. 36830.).

Wall ultrastructure and sporogenesis were studied in plasmodia of *Henneguya adiposa* Minchew which infects the channel catfish, *Ictalurus punctatus* (Rafinesque). Plasmodia were located among connective tissue bands of the adipose fin and were always separated from host fibrocytes by collagen fibers. The plasmodium wall consisted of a single unit membrane which was continuous with numerous pinocytic canals extending into the parasite's ectoplasm. The membrane was highly convoluted, producing an irregular parasite surface, and was covered by a fine granular coat of almost uniform thickness. Early sporogenic stages were located in a zone of cytoplasm rich in mitochondria, just interior to the zone of pinocytic canals. Later sporogenic stages, including mature spores, were concentrated in the center of the plasmodia. Sporogenesis began with the envelopment of one generative cell, the sporont, by a second, nondividing, cell—the enveloping cell. The sporont and its progeny proceeded through a series of divisions until 10 cells were present within the enveloping cell. Once divisions were completed, the 10 cells became arranged into two identical spore-producing units, each consisting of one binucleate sporoplasm and two capsulogenic cells, all surrounded by two valvogenic cells. Later stages of spore development indicated that capsulogenesis, valvogenesis, and sporoplasm maturation occurred concomitantly. (Author). 000974

000491

Curtis, M. A.

1981. Observations on the occurrence of *Diplostomum spathaceum* and *Schistocephalus* sp. in ninespine sticklebacks (*Pungitius pungitius*) from the Belcher Islands, Northwest Territories, Canada. J. Wildl. Dis. 17(2):241-246. (Inst. Parasitol. McGill Univ. Macdonald Coll. Ste. Anne de Bellevue, P. Q. Canada H9X 1C0.).

All 175 ninespine sticklebacks, *Pungitius pungitius* (Linne), collected from the Belcher Islands were parasitized by *Diplostomum spathaceum* (Rudolphi) and 43 per cent by *Schistocephalus* sp. *D. spathaceum* metacercariae were mostly confined to a dorso-ventral band encircling the lens of the eye, and were concentrated in the antero-dorsal sector of this band. The central area of the lens was thus



relatively free of diplostomula, probably minimizing interference with the vision of the fish. The frequency distribution of *D. spathaceum* abundance in *P. pungitius* was closely approximated by a negative binomial, while that for *Schistocephalus* was best fitted by a Poisson. None of the fish condition factors examined appeared related to the intensity of the parasitic infections. (Author). 001121.

000492

de Kinkelin, P., Le Berre, M. B., Bernard, J.

1980. Viral hemorrhagic septicemia of rainbow trout: selection of a thermoresistant virus variant and comparison of polypeptide synthesis with the wild-type virus strain. *J. Virol.* 36(3):652-658. (Inst. Natl. Recherche Agronomique, Lab. Ichtyopathol. 78850 Thiverval-Grignon, France.).

Serial passage of viral hemorrhagic septicemia virus at gradually increasing temperature selected for a variant virus that replicates at 25°C and has a low pathogenicity for rainbow trout. Viral hemorrhagic septicemia virus-specific polypeptide synthesis was examined in epithelioma papulosum cyprini cells infected with either a wild-type strain or a thermoresistant variant. The wild-type N and M<sub>1</sub> proteins were synthesized throughout the course of infection, whereas L, G, and M<sub>2</sub> were more actively translated later in the replication cycle. The wild-type strain was more cytotoxic at 25 than at 14°C despite the fact that no translation could be evidenced when the temperature was raised. When epithelioma papulosum cyprini cells were infected with the variant virus, the kinetic study was obstructed since protein synthesis was difficult to observe by the pulse method at a low multiplicity of infection and aborted when the multiplicity of infection was raised. The variant was less cytotoxic at 25°C than the wild-type virus. (Authors). 001002.

000493

Dorson, M., Torchy, C.

1981. The influence of fish age and water temperature on mortalities of rainbow trout, *Salmo gairdneri* Richardson, caused by a European strain of infectious pancreatic necrosis virus. *J. Fish Dis.* 4(3):213-221. (Lab. Ichtyopathol. I.N.R.A. 78850 Thiverval-Grignon, France.).

Rainbow trout fry were infected by a pathogenic Sp type of infectious pancreatic necrosis virus isolated in France. Fry held at 10°C and infected at

different ages showed a decrease of sensitivity with increasing age and ceased to be susceptible to the disease when 20 weeks old. Mortality was delayed at 6°C and lowered or suppressed at 16°C. When fry were moved from 10 to 16°C before infection mortality was also lowered but not when they were moved from 16 to 10°C. Late infection of siblings kept at different temperatures before infection suggested a relation between the number of degrees × days and the final mortality recorded. (Authors). 001100.

000494

Ellis, A. E., Hastings, T. S., Munro, A. L. S.

1981. The role of *Aeromonas salmonicida* extracellular products in the pathology of furunculosis. *J. Fish Dis.* 4(1):41-51. (Mar. Lab. Victoria Rd. P. O. Box 101, Aberdeen AB9 8BD, Scotland.).

The extracellular products (ECP) of *Aeromonas salmonicida*, prepared by the cellophane overlay method, are lethal to rainbow trout when administered parenterally. Sublethal doses when injected ip or im are shown to reproduce all the lesions that have been described in the literature as being associated with furunculosis. In addition, meningitis may be an important feature of furunculosis and is reproduced by injection of ECP. A serum factor, probably an α globulin, present in normal serum of rainbow trout, is capable of neutralizing the toxic effects of ECP. The pathology is discussed with reference to the proteolytic and leucocidal properties of the ECP and its effects upon the eosinophilic granular cells which are caused to disperse and degranulate with the possible release of histamine. (Authors). 001125

000495

Endo, M., Miyazaki, T., Kubota, S. S., Ohbayashi, T., Nagano, T., Matsumoto, N.

1979. Studies on the nutritional myopathy syndrome in cultured fishes—II. Nutritional myopathy in cultured young puffers. *Fish Pathol.* 13(4):183-187. (Dep. Fish. Fac. Agric. Miyazaki Univ. Funatsuka, Miyazaki, Japan.).

In 1974, 1975 and 1976, nutritional myopathy occurred among cultured young puffers (*Fugu rubripes*) fed frozen fish meat, in a farm in Kagawa Pref. They were very thin and slender in appearance. One hundred and fifty three diseased puffers were examined histopathologically.

This case was characterized by degeneration and necrosis of skeletal muscle fibers, proliferation of

connective tissue and appearance of ceroid-laden macrophages in the stroma. It was found that such changes advanced more severely and quickly in erector and depressor muscle tissues than in lateral muscle tissues. In advanced cases most of the skeletal muscle fibers disappeared, and the connective tissue proliferated and ceroid-laden macrophages appeared markedly in the stroma.

The lipopigment was deposited in parenchymal cells in the liver. This lipopigment was similar to ceroid in histochemical nature except that the pigment had no acid-fastness. Ceroid-laden macrophages appeared in the spleen, kidney, and intestine.

The present authors consider the above-mentioned changes closely resemble yellow-fat disease in mammals and aves. (Authors). 000966. (Paper in Japanese)

000496

Enzmann, P. J.

1980. Preparation of salmonid white blood cells for virological studies. Page 185 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Fed. Res. Inst. Anim. Virus Dis. P. O. Box 1149, D-7400 Tübingen, Fed. Rep. Germany.).

(Abstract only). 001160

000497

Esch, G. W., Hazen, T. C.

1980. Stress and body condition in a population of largemouth bass: implications for red-sore disease. Trans. Am. Fish. Soc. 109(5):532-536. (Dep. Biol. Wake Forest Univ. Winston-Salem, N. Car. 27109.).

The body conditions,  $K = 10^4(\text{weight, g}) \div (\text{standard length})^3$ , and various hematological characters were examined for largemouth bass (*Micropterus salmoides*) taken from Par Pond, a reservoir heated by effluent from a nuclear production reactor at the Savannah River Plant near Aiken, South Carolina. Large mouth bass with K less than 2.0 had significantly lower ( $P < 0.05$ ) hematocrits, hemoglobin concentrations, total red blood cell counts, total white blood cell counts, and lymphocyte fractions and significantly higher granulocyte fractions and cortisol concentrations, than those with K greater than 2.0; monocyte, thrombocyte, and reticulocyte fractions were not different between the two K-factor groupings. When data were pooled, all blood variables except the reticu-

lyocyte fraction were significantly correlated with K. Hematocrit, the lymphocyte fraction, and cortisol concentration account for 20.5% of the variation in K. These data support a previous hypothesis that elevated water temperature promotes stress. Stress within the Par Pond largemouth bass population may play an important role in the epizootiology of red-sore disease caused by the gram-negative bacterium *Aeromonas hydrophila*. (Authors). 001009.

000498

Evelyn, T. P. T., Ketcheson, J. E.

1980. Laboratory and field observations on antivibriosis vaccines. Pages 45-52 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Dep. Fish. Oceans, Pac. Biol. Stn. Nanaimo, B. C. Canada V9R 5K6.).

001139.

000499

Faisal, M., Ahne, W.

1980. Use of immunoperoxidase technique for detection of fish virus antigens. Pages 186-192 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Inst. Zool. Hydrobiol. Ludwig Maximilians Univ. Kaulbachstrasse 37, D-8000 Munich 22, Fed. Rep. Germany.).

001161.

000500

Fischthal, J. H., Fish, B. L., Vaught, R. S.

1980. Comparative allometric growth of the digenetic trematode *Metadana globosa* (Linton 1910) Manter 1947 (Cryptogonimidae) in three species of Caribbean fishes. J. Parasitol. 66(4):642-644. (Dep. Biol. Sci. State Univ. New York at Binghamton, Binghamton, N. Y. 13901.).

Allometric growth was compared for *Metadana globosa* from three species of lutjanid fishes from Belize. Significant differences in allometric growth of the trematode involved (1) the oral sucker in all three species of fishes; (2) body width, posttesticular space, pharynx, and testes in *Lutjanus analis* and *Ocyurus chrysurus*; (3) forebody, pharynx and acetabulum in *L. analis* and *L. synagris*; and (4) forebody and posttesticular space in *L. synagris*

and *O. chrysurus*. Differences in the acetabulum of specimens from *L. analis* and *O. chrysurus* and in the testes of those from *L. synagris* and *O. chrysurus* tended to be significant, whereas no significant effect was noted for the hindbody and ovary in any host species. (Authors). 001075.

000501

Fryer, J. L., Rohovec, J. S., Pulford, E. F.,  
Olson, R. E., Ransom, D. P., Winton, J. R.,  
Lannan, C. N., Hedrick, R. P., Groberg, W.  
J.

1979. Proceedings from a conference on disease inspection and certification of fish and fish eggs. Oregon State Univ. Sea Grant Coll. Program, ORESU-W-79-001, 1979. 40 pp. (Dep. Microbiol. Oregon State Univ. Corvallis, Oreg. 97331.).

The Conference was held 13-14 January 1978 at Corvallis, Oregon and presentations were made by persons from Oregon State University, the Oregon Department of Fish and Wildlife, and Oregon Aquafoods. Each paper is listed as separate entries in this issue. (Ken Wolf). 001110.

000502

Gayer, E. K., Bekesi, L., Csaba, G.

1980. Some aspects of the histopathology of carp erythrodermatitis (CE). Pages 127-136 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Cent. Vet. Inst. 1581 Budapest, Pf. 2, Hungary.).

001153.

000503

Ghittino, P.

1980. Mortality (in percent) by unidentified factors in fish farming. (Mortalita da cause non identificabili in trotticoltura e sua incidenza percentuale.) Riv. Ital. Piscicol. Ittiopatol. 15(2):33-35. (Istituto Zooprofilattico Sperimentale, Via Bologna, 148 - 10154 Torino, Italy.).

In spite of recent progress in scientific knowledge, fish farming must still contend with mortality from unidentified factors - the so-called natural mortality. The author used information from the literature and results from a preliminary survey of some commercial trout farms in Italy to arrive at estimates of production and hence of operational costs and income. He considers that

natural losses of brood stock amount to about 15%. From egg to fingerling stage the loss is about 25% and to the time of harvest about 30%. For practical purposes, the operator can expect that only 25% of the starting number of eggs will reach marketable size. (Author). 001039. (Paper in Italian)

000504

Ghittino, P.

1980. Checking on the suitability, toxicity and carcinogenicity of TOPRINA in rainbow trout. Final report. (Controllo della convenienza, tossicità e cancerogenicità di TOPRINA nella trota iridea rapporto finale.) Riv. Ital. Piscicol. Ittiopatol. 15(2):36-45. (Inst. Zooprofilattico Sperimentale, Via Bologna, 148 - 10154 Torino, Italy.).

Yeast grown on paraffin medium is the source of BP TOPRINA, a protein meal. A 2-year study was conducted with pelleted rations containing 10, 20, or 30% yeast meal in lieu of fish meal. Commercial trout ration served as a negative control while another ration incorporated a 10% level of peanut meal containing aflatoxin. Conversion factors on the yeast meal were 1.75-2.11:1, but muscle contained 18 to 38 times more n-paraffins than control tissue. Trout fed the 30% level of yeast meal were successfully spawned twice and progeny were normal. Histopathological examinations were carried out monthly and ceroid, melanosis, and colangitis were detected in all groups. Aflatoxicosis was evident among fish fed the peanut meal, but only after 18 months; it did not occur in the groups fed yeast meal. The author concludes that yeast meal is an acceptable component of trout rations. (Author). 001037. (Paper in Italian)

000505

Giussani, G., De Bernardi, R., Mosello, R., Ghittino, P.

1980. Limnological features of Lago di Candia (Piedmont, Italy) during a heavy fish mortality by branchiomycosis. (Situazione limnologica del lago di Candia (Piemonte) in concomitanza con una grave mortalità ittica da Branchiomicosi.) Riv. Ital. Piscicol. Ittiopatol. 15(2):46-52. (C.N.R. Istituto Italiano Idrobiologia, 28048 Verbania Pallanza (Novara), Italy.).

During July 1979 in Lago di Candia, a shallow small lake in North-West Italy, the populations of the two most abundant cyprinids *Scardinius eryth-*

*rophthalmus* and *Tinca tinca* have been interested by an acute massive mortality.

The analysis of the gill apparatus of the dead fishes allowed us to recognize in an infection due to a fungus belonging to the genus *Branchiomyces* (*Phycomycetes Saprolegniales*) the cause of the mortality. Furthermore the main physical, chemical and biological parameters have been measured in order to achieve a picture of the limnological features not only to define the environmental situation in which the infectious disease occurred, but also to fill the gap of knowledge on Lago di Candia.

The results indicate an advanced eutrophication of this lake and confirm the close relation between *Branchiomyces* infection and high trophic levels of the environment as suggested by different authors. (Authors). 001040. (Paper in Italian)

000506

Groberg, W.

1979. Collection and preparation of samples for viral examination. Pages 32-35 in J. L. Fryer, J. S. Rohovec, E. F. Pulford, R. E. Olson, D. P. Ransom, J. R. Winton, C. N. Lannan, R. P. Hedrick, and W. J. Groberg, eds. Proceedings from a conference on disease inspection and certification of fish and fish eggs. Oreg. State Univ. Sea Grant Coll. Progr. (Oregon Dep. Fish Wildl. P. O. Box 3503, Portland, Oreg. 97208.).

001117.

000507

Harrison, J. G.

1980. Nephrocalcinosis of rainbow trout (*Salmo gairdneri* Richardson) in freshwater; a survey of affected farms. Pages 193-197 in Ahne, W. ed. Fish Diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Unit Aquat. Pathobiol. Stirling Univ. Stirling, Scotland.).

001162.

000508

Harshbarger, J. C.

1980. Activities report: Registry of tumors in lower animals: 1979 supplement. Registry of Tumors in Lower Animals, Natl. Mus. Nat. History, Smithsonian Inst. Washington, D. C. 1980.

44 pp. (Registry of Tumors in Lower Animals, Natl. Mus. Nat. History, Room W216-A, Smithsonian Inst. Washington, D. C. 20560.).

The 1979 supplement to the Activities Report, Registry of Tumors in Lower Animals, Smithsonian Institution, Washington, D. C. has been released. Director J. C. Harshbarger notes that among the 179 accessions made during the year that 57% were from bony fishes. As with previous annual supplements, the accessions are listed numerically and give common and scientific names of hosts, habitat, diagnosis, submitter, and a description of the material, i.e. tissue, microslide, or whole animal. (Ken Wolf). 001109.

000509

Hartman, P., Kudrlicka, J.

1980. Prevention of gill necrosis in fish by the control of the photosynthetic assimilation of pond phytocenosis. (Prevenec nekrozy zaber ryb rizenim fotosyntetické asimilace rybníční fytocehozy.) Bul. VURH Vodnany 3(16):11-15. (Statní rybarství, obor. podnik, trída Miru 30/A, 371 38 Ceske Budejovice, Czechoslovakia.).

Laboratory tests were performed to study the effect of the yellow and red color of water on the development of the alga *Scenedesmus quadricauda* and mixed algal culture of ponds; the purpose was to reduce their development. The coloring agents (tartrazin C 307 yellow and C 120 cochineal red) were applied in a concentration of 1 ppm and 2 ppm. The aquariums were permanently lightened and aerated. The color of the water, causing an increased absorption of the part of sunlight spectrum which is necessary for aquatic plant assimilation reduced the development of algae in all cases. The disintegration of the coloring agents was examined by extinction. The agents were found to be very stable and suitable for use in the prevention of gill necrosis which is induced by an increased water pH as a result of high photosynthetic assimilation of aquatic plants. (Authors). 001086. (Paper in Czech.)

000510

Hastein, T., Hallingstad, F., Refsti, T., Roald, S. O.

1980. Recent experience of field vaccination trials against vibriosis in rainbow trout (*Salmo gairdneri*). Pages 53-59 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Natl. Vet. Inst. Oslo, Norway.).



001140.

000511

Hatai, K., Hirose, H., Hioki, M.,  
Miyakawa, M., Egusa, S.

1979. *Dermocystidium anguillae* found on the gills of the European eel, *Anguilla anguilla* cultured in Japan. *Fish Pathol.* 13(4):205-210. (Central Res. Lab. Sankyo Co. Hiromachi, Shinagawa-ku, Tokyo, Japan.).

An epizootic of dermocystidiosis occurred among pond-cultured European eels, *Anguilla anguilla* for the first time at a fish farm in Shizuoka Prefecture. The fungus was identified as *Dermocystidium anguillae* which was first reported by Spangenberg (1975) in East Germany. The cysts were parasitic in the epithelial and connective tissues of the gills. Attempts were made to culture the parasite on some media, but without success.

When the water temperature of tanks with the diseased eels was experimentally raised from 20°C to 30°C, the cysts disappeared from the gills of all the eels within a few days, which suggested that this disease could be cured by warm-water bathing. (Authors). 000963. (Paper in Japanese)

000512

Hedrick, R. P.

1979. Viral diagnosis: isolation and identification. Pages 36-38 in J. L. Fryer, J. S. Rohovec, E. F. Pulford, R. E. Olson, D. P. Ransom, J. R. Winton, C. N. Lannan, R. P. Hedrick, and W. J. Groberg, eds. Proceedings from a conference on disease inspection and certification of fish and fish eggs. Oreg. State Univ. Sea Grant Coll. Progr. (Dep. Microbiol. Oregon State Univ. Corvallis, Oreg. 97331.).

001118.

000513

Hill, B. J., Dorson, M., Dixon, P. F.

1980. Studies on immunization of trout against IPN. Pages 29-36 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Minist. Agric. Fish. Food, Dir. Fish. Res. Fish Dis. Lab. Weymouth, Dorset DT4 8UB, England.).

001137

000514

Hilton, L. R., Wilson, J. L.

1980. Terramycin-resistant *Edwardsiella tarda* in channel catfish. *Prog. Fish-Cult.* 42(3):159. (Dep. For. Wildl. Fish. Univ. Tennessee, Knoxville, Tenn. 37916.).

First report of Terramycin resistance in *Edwardsiella tarda* from channel catfish. (Ken Wolf). 000997

000515

Hine, P. M.

1980. A review of some species of *Myxidium* Butschli, 1882 (Myxozosporea) from eels (*Anguilla* spp.). *J. Protozool.* 27(3):260-267. (Fish. Res. Div. Minist. Agric. Fish. P. O. Box 19-062, Wellington, New Zealand.).

*Myxidium* spores from various eel hosts (*Anguilla* spp.) are compared. *Myxidium anguillae*, *M. enchelypterygii*, *M. illinoisense*, *M. serum*, and *M. zealandicum* are synonymized with *M. giardi*, a ubiquitous species reported from *A. anguilla*, *A. rostrata*, *A. mossambica*, *A. japonica*, *A. reinhardtii*, *A. bicolor pacifica*, *A. australis*, and *A. dieffenbachii*. *Myxidium uchiyamae*, *M. lentiforme*, *M. matsuii* and *M. acinum* are retained, and two new species described. Species other than *M. giardi* appear to be restricted to the Indo-Pacific region. (Author). 001055.

000516

Horiuchi, M., Sato, T., Takagi, H.,  
Tozuka, K.

1980. Studies on rapid diagnosis system of main bacterial diseases of pond-cultured eels in Japan-I. Basic investigations on the diagnosis of Edwardsiellosis by direct immunofluorescence. *Fish Pathol.* 15(1):49-55. (Nihon Nosan Kogyo Co. Ltd. Res. Cent. Midori-ku, Yokohama 226, Japan.).

Epizootics of Edwardsiellosis have been frequently occurring among pond-cultured eels, *Anguilla japonica* in Japan. Accurate diagnosis of the disease by means of conventional cultural method requires a day or more for completion. In this report, basic investigations for the application of



direct immunofluorescence as rapid diagnostic tool of the disease were made.

Antiserum was obtained from rabbit immunized with formalin-killed *E. tarda* (strain E-8) isolated from eel. The titer against formalin-killed homologous antigen was 1:2048 by agglutination test. IgG of the antiserum was fractionated by ammonium sulfate precipitation and conjugated with FITC. The F/P molar ratio of labeled antibody was determined as 1.3.

The labeled antibody had staining titer of 1:16 or 1:32 against 18 strains of *E. tarda*, including homologous strain E-8, isolated from pond-cultured eels at various regions in Japan. But no cross-reaction was observed when two strains of *V. anguillarum*, three of *Vibrio* sp. three of *A. liquefaciens*, eight of *Aeromonas* sp. one of *P. anguilliseptica*, one of *P. fluorescens*, one of *P. putida*, one of *Escherichia coli*, two of *Salmonella* sp. one of *S. marcescens* and one of *F. columnaris* were stained.

The specific fluorescence of target antigen (*E. tarda*) was observed when acetone-fixed impression preparations of liver, kidney, spleen, and injection site of muscle derived from artificially infected eel were stained with 4-fold dilution of labeled antibody. The specificity of the reaction on impression preparation was ascertained by one-step inhibition test. Stainability of *E. tarda* on impression preparation was stable for at least 11 days at 37°C. Stainability of *E. tarda* on impression preparation of liver tissue that had been preserved in 10% formalin for at least 7 days, though became slightly weaker, was not disappeared. (Authors). 001050. (Paper in Japanese)

000517

Hosmer, M. J.

1980. Handling as a factor in mortality of trout with or without furunculosis. Prog. Fish-Cult. 42(3):157-159. (U.S. Fish Wildl. Serv. Exp. Hatch. Natl. Fish. Cent.-Leetown, Kearneysville, W. Va. 25430.).

Mortalities of brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), and rainbow trout (*Salmo gairdneri*) in 1978 and 1979 were significantly higher in clinically diseased than in sub-clinically diseased or healthy fish in both years. Mortalities in diseased fish with 24 h after sampling were not statistically different from those in specific-pathogen-free controls; however, the crowding of fish lots for stocking resulted in significantly higher mortalities in furunculosis-infected brown trout in 1979. Crowding and handling for stocking thus caused higher mortality in diseased

fish than just sampling. Healthy trout were able to tolerate more handling stress. (Author). 001034

000518

Hubbert, R. M., Williams, W. P.

1980. Ulcer disease of roach, *Rutilus rutilus* (L.). Bamidgeh 32(2):46-52. (Chelsea Coll. Univ. London, England.).

A population of roach *Rutilus rutilus* (L.) with ulcer disease was examined over the course of 1 year. A bacterium identified as *Aeromonas salmonicida* subsp. *achromogenes* was consistently isolated from ulcers and blood of infected fish but was not present on the skin or in the blood of fish without ulcers. (Authors). 001025.

000519

Imada, K.

1979. Histological observation on the deformed pond smelt, *Hypomesus olidus*, collected in Hokkaido. Sci. Rep. Hokkaido Fish Hatch. 34:41-45. (Nakanoshima, Toyohira-Ku, Sapporo, Hokkaido, Japan.).

Deformed fish, *Hypomesus olidus*, collected from Barato River one of the branches of Ishikari River in Hokkaido, were observed with morphological and histological methods. One of the specimens was lordosis and kyphosis and X-ray photograph of this fish showed the sigmoid vertebrae. Another two specimens, shortened bodies, were heavy coalescence of their vertebrae. Histological features of sigmoid fish showed the normal centrum in abdominal vertebrae, but in caudal part some centrum were deformed and were hypertrophic at the outward of curvature. Coalescent centrum of shortened fish changed their original forms, hour glass-shape, and the fibrous sheath were not regularly. At the conjunctive part of centrum, the fibroblasts and cartilage cells were hyperplastic and cartilage bone appeared surrounding these cartilage cells. (Author). 001076. (Paper in Japanese)

000520

Inoue, K., Shimura, S., Saito, M., Nishimura, K.

1980. The use of trichlorfon in the control of *Argulus coregoni*. Fish Pathol. 15(1):37-42. (Okutama Branch, Tokyo Metrop. Fish. Exp.

Stn. Kotaba, Okutama-cho, Tokyo 198-01, Japan.).

Examinations were made on the pesticidal effects of trichlorfon against *Argulus coregoni* parasitic on yearling yamame (*Oncorhynchus masou*) and on the lethal effects of trichlorfon on four species of juvenile salmonids such as yamame, brook trout (*Salvelinus fontinalis*), rainbow trout (*Salmo gairdneri*) and brown trout (*Salmo trutta*).

The pesticidal effects of trichlorfon causing 100% mortality of *A. coregoni* at 20°C and pH 7.0 were obtained by the immersions in 6.25 ppm for 1 h, 12.5-50 ppm for 30 min, 100ppm for 10 min. The higher temperature and the higher pH value were found to increase the effects.

The immersion of the following concentrations and durations removed more than 90% of the parasite from the host: 12.5 ppm for 60 min, 40 ppm for 30 min, 100 ppm for 20 min, 200 ppm for 10 min, and 400 ppm for 30 min at 17-18°C, although the immersion in 3.13 ppm for 60 min, 10 ppm for 30 min, and 80 ppm for 5 min showed poor effects of less than 10% removal.

As to the lethal effects on salmonids, the immersion in the solution up to 800 ppm for 1 h at 16-17°C caused neither death nor abnormal behavior of each 10 test fish. However, the high mortality occurred in the immersion for longer period up to 18 h in the solutions ranging 6.25 to 400 ppm at 16-18°C. Although there were slight differences in the susceptibility among the four species, *S. salvelinus* was relatively susceptible while *S. gairdneri* being resistant to trichlorfon. (Authors). 001033. (Paper in Japanese)

000521

Iwama, G. K.

1980. Incubation times resulting from experimental injections of kidney disease bacteria into juvenile coho salmon. Prog. Fish-Cult. 42(3):182-183. (Fish Wildl. Branch, Minist. Environ. 400, 1019 Wharf Street, Victoria, B. C. Canada V8W 2Y9.).

Culture grown organisms were suspended at O.D. (420 nm) of 0.25, 0.10, and 0.01 and inoculated intraperitoneally into groups of twenty 14 gram fish at 9-11°C, pH 6.8-6.9, 54 mg per liter CaCO<sub>3</sub>. Mortality was proportional to inoculum: 34-45 days at 0.25, 34-49 days at 0.10, and 49-58 days at 0.01. Fish showed clinical signs typical of bacterial kidney disease. (Ken Wolf). 000996.

000522

Janusz, J.

1979. Occurrence of the parasite *Clavella adunca* (Strom, 1762) (*Copepoda parasitica: Lernaeopodidae*) on the cod (*Gadus morhua* L.) from North Atlantic waters. (Występowanie pasożyta *Clavella adunca* (Strom, 1762) (*Copepoda parasitica; Lernaeopodidae*) na dorszach (*Gadus morhua* L.) wód polnocnego Atlantyku.) Acta Ichthyol. Piscatoria 9(2):37-54. (Morski Inst. Rybacki, (Sea Fish. Inst.), 81-345 Gdynia, Al. Zjednoczenia 1, Poland.).

The studies of the infestation state of the cod (*Gadus morhua* L.) by the *Clavella adunca* (Strom, 1762) parasite were carried out in North Atlantic waters over the years 1970, 1974 and 1975. Totally 7,168 cod specimens have been subjected to detailed ichthyological analysis, 4,454 cods originating from Labrador and New Foundland fish grounds and 2,714 from Spitsbergen Island fishing grounds.

The results of observations of the parasite occurrence on the particular parts of cod body are presented in the work. The observations of differences in body-build proportions of female parasite and forms of bullae originating from different locations of attachment to the host were made as well.

By the use of Student's test *t* the significance of differences in infestation of cods from different regions was estimated. (Author). 001068.

000523

Jensen, N. J., Larsen, J. L.

1980. Seasonal occurrence of *Aeromonas salmonicida* carriers. Pages 87-89 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Royal Vet. Agric. Univ. Copenhagen, Denmark.).

001145.

000524

Jorgensen, P. E. V.

1980. Egtved virus: the susceptibility of brown trout and rainbow trout to eight virus isolates and the significance of the findings for the VHS control. Pages 3-7 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (State Vet. Serum Lab. Dep. Jutland, Hangovej 2, 8200 Arhus N, Denmark.).

001132.

000525

Kashiwagi, S., Sugimoto, N., Matsuda, T.

1980. Chemotherapeutical studies on furazolidone against Edwardsiellosis in cultured eel. *Fish Pathol.* 15(1):31-36. (Res. Lab. Ueno Fine Chemical Ind. Higashiarioka Itami, Hyogo, Japan.).

Antibacterial activity of furazolidone (N-(5-nitro 2 furyliden)-3-amino-2-oxazolidone, FZD) against *Edwardsiella tarda* isolated from diseased eel, *Anguilla japonica*, and therapeutic effect of the drug by medical bath against experimental Edwardsiellosis in young eel were studied.

Minimal inhibitory concentration of FZD against 30 strains of *E. tarda* was 0.03-5.0 ppm and sensitivity distribution curve had two peaks. One peak was at 0.07 ppm and the other at 1.2 ppm.

FZD was highly effective by medical bath at over 1 ppm against experimental Edwardsiellosis with *E. tarda* A strain (MIC was 0.07 ppm) and effective at over 4 ppm with *E. tarda* B strain (MIC was 1.2 ppm). (Authors). 001035. (Paper in Japanese)

000526

Katae, H., Kouno, K., Shimizu, M., Kusuda, R., Taniguchi, M. Shiomitsu, K., Hasegawa, H.

1980. Studies on chemotherapy of fish disease with erythromycin-I. Absorption, distribution, excretion and residue of erythromycin in cultured yellowtails. *Fish Pathol.* 15(1):7-16. (Dainippon Pharm. Co. Ltd. Res. Lab. Osaka, 541 Japan.).

The pharmacokinetic and residual examinations of erythromycin (EM) were studied in cultured yellowtails *Seriola quinqueradiata* orally administered a single or multiple dose(s) of 50 mg/kg/day with the following results.

Orally administered EM produced peak levels in blood and tissue 1 to 3 h post-dosing and the levels in liver, kidney, and spleen were about four times as high as that in blood. The level in muscle was approximately equal to that in blood.

A single dose of EM produced blood and tissue levels which were 10 to 100 times as high as the MIC for *Streptococcus* sp. 1 h post-dosing, and

higher levels than the MIC were detected 24 h following administration.

Blood and tissue levels of EM after ten consecutive administrations were almost same or slightly higher than those obtained by the single administration, though their distribution patterns were similar.

After the withdrawal of ten consecutive dosing, levels of EM in blood and tissue decreased exponentially, and biological half-lives were blood; 5.00-7.78 h, liver; 8.37-9.75 h, kidney; 14.80-15.63 h, spleen; 14.32-15.89 h, muscle; 7.15-8.17 h. A level below the assay limits (0.03-0.08 µg/ml or g) was reached 144-168 h post-dosing.

No evidence of long term residue was found in any of the tissues tested. (Authors). 001051. (Paper in Japanese)

000527

Kawatsu, H., Sakai, T.

1980. Hyperbilirubinemia in cultured eel. *Bull. Jpn. Soc. Sci. Fish.* 46(7):809-812. (Fac. Agric. Miyazaki Univ. 210, Funatsuka-3, Miyazaki 880, Japan.).

An outbreak of hyperbilirubinemia occurred in cultured eel and diseased fish were macroscopically distinguished by yellowish surface discoloration of the abdomen and fins. Their livers exhibited many minute white spots and congestion; their total bilirubin levels were 4.6-14.2 mg/100 ml, approximately thirty times higher than normal. Direct reacting bilirubin was 70.3-80.8% of total bilirubin. GOT and GPT levels were 73-304 and 12-37 Karmen units, respectively, approximately four times higher than normal. No significant difference in alkaline phosphatase activity was noted between normal and the diseased eels. The present hyperbilirubinemia was categorized as predominant type of conjugated bilirubin, associated with multifunctional liver cell impairment. (Authors). 001057.

000528

Khan, R. A.

1980. The leech as a vector of a fish piroplasm. *Can. J. Zool.* 58(9):1631-1637. (Dep. Biol. Mar. Sci. Res. Lab. Memorial Univ. Newfoundland, St. John's, Nfld. Canada A1C 5S7.).

A piroplasm, *Haemohormidium beckeri*, is redescribed from two marine fish, *Lycodes lavalaei* and *Lycodes vahlii* (Zoarcidae). The parasite divided by

both binary fission and schizogony. In the latter process, up to eight merozoites were produced and these developed within mature erythrocytes. Infections were prevalent among fish from areas off the Labrador coast. Parasitemias, which varied from light infections to estimates of 60 parasites/1000 erythrocytes, were recorded in 15 fish for about 6 months. Subinoculation of infected blood initiated infections in two perciform fish, *Myxocephalus octodecemspinosus* and *Anarhichas lupus*, but not in a pleuronectiform, *Psuedopleuronectes americanus*, or a gadiform, *Gadus morhua*. Natural infections were present in three leeches, *Platybdella olriki*, that had fed on an infected *L. lavalaei*. Piroplasms were also observed in the gastrointestinal content of all 94 laboratory-reared leeches. *Johannsonia arctica*, dissected 7 through 109 days after engorgement on infected fish blood. Inoculations of gut contents from leeches after digestion of a blood meal produced infections in uninfected fish. Natural transmission occurred when leeches were fed again on susceptible fish, whereas pipetting entire leeches into the stomach of fish did not initiate infections. This is the first evidence that leeches transmit piroplasms in nature to fish. (Author). 001059.

000529

Khan, R. A., Murphy, J., Taylor, D.

1980. Prevalence of a trypanosome in Atlantic cod (*Gadus morhua*) especially in relation to stocks in the Newfoundland area. Can. J. Fish. Aquat. Sci. 37(10):1467-1475. (Dep. Biol. Mar. Sci. Res. Lab. Memorial Univ. Newfoundland, St. John's, Nfld. Canada A1C 5S7.).

A study was initiated to ascertain the prevalence of a trypanosome in Atlantic cod (*Gadus morhua*) especially in relation to stocks in the Newfoundland area and as an aid in management and conservation. Highest prevalences were recorded in fish taken off the Labrador coast (ICNAF divisions 2J and 3K, 94 and 90%, respectively). Trypanosomes were not as prevalent in fish collected from the northern Grand Bank (46%, division 3L) or from the southern Grand Bank (13 and 16%, divisions 3N and 3O, respectively). A further decrease in prevalence occurred among fish collected on the Flemish Cap (10%, division 3M) and St. Pierre Bank (8%, subdivision 3Ps), while the lowest levels (4%) were apparent in cod taken from the Gulf of St. Lawrence (divisions 4R and 4S). Fish sampled at inshore localities reflected prevalences corresponding to some extent to off-shore localities. Cod taken on coastal Labrador and from northern Newfoundland have a high prevalence of trypanosome infections while in the more easterly bays, intermediate levels occur. A conspicuous decrease in prevalence was apparent

in a sample taken from the most easterly inshore locality (Portugal Cove) and from two others on the south coast of Newfoundland. Lowest prevalences were noted among fish taken at four inshore localities in the Gulf of St. Lawrence. These results, based on prevalences of infection, support conclusions from other studies that there are at least six stocks of cod in the Newfoundland area with some degree of mixing. (Authors). 001066.

000530

Kimura, M., Endo, M.

1979. Whirling disease caused by metacercaria of a fluke. Fish Pathol. 13(4):211-213. (Dep. Fish. Fac. Agric. Miyazaki Univ. Funatsuka, Miyazaki, Japan.).

From middle July to late August every year, whirling disease caused by the metacercaria of a fluke occurs in natural anchovies (*Engraulis japonica*) and cultured yellowtails (*Seriola quinqueradiata*) in the Tsushima Islands. The only symptom is circular swimming, or whirling, near the sea surface. Fifty diseased anchovies, 100 diseased yellowtails and 10 normal yellowtails were examined parasitologically and histopathologically.

All the diseased fishes examined had one or at times two metacercaria within the interbrain, but it was never detected in the normal fishes. Neither pathogenic bacteria nor protozoa were found in any of the diseased fishes.

The metacercaria cyst was white and had the diameter of about 0.8 mm. According to Kamegaya et al. (unpublished) this fluke belongs to the genus *Galactosmum*. Neurons around the metacercaria in the interbrain were found to fall into degeneration or necrosis affected by pressure of the cyst.

Because of the above-mentioned facts, the present authors consider that whirling movement of the infected fishes caused by the metacercaria. (Authors). 000962. (Paper in Japanese)

000531

Kirpichnikov, V. S., Faktorovich, K. A.

1972. Increase in the resistance of carp to dropsy by means of breeding. Communication II. The course of the selection and evaluation of the breeding groups selected. Sov. Genet. (Engl. transl. Genetika) 8(5):592-600. (All-Union Sci.-Res. Inst. Pond Fish Farming, Dmitrov, USSR.).

The report describes results of selective breeding carried out during 1969-1970, developments in a



program that began in 1963. Four stocks of carp were assessed for growth, viability, and resistance to dropsy. Disease challenge was effected by co-habitation of experimentally infected fish with healthy fish, a move necessitated by failure of natural infections to occur consistently among surviving progeny of earlier selections. Suspensions of brains from clinically diagnosed victims of dropsy were inoculated intraperitoneally, but no virology was carried out. Hybrids between the Ropshian strain and a local stock of unspecified and mixed origins had the best growth, viability, and resistance to dropsy. Hybrids showed a 2% incidence of dropsy; the unspecified local stock 30%, the Ropshian less than 1%. (Ken Wolf). 000981.

000532

Knittel, M. D.

1981. Susceptibility of steelhead trout *Salmo gairdneri* Richardson to redmouth infection *Yersinia ruckeri* following exposure to copper. J. Fish Dis. 4(1):33-40. (U.S. Environ. Prot. Agency, Corvallis Environ. Res. Lab. Freshw. Div. Toxicol. Corvallis, Oreg. 97330.).

Steelhead trout were exposed to sublethal concentrations of copper and inoculated with *Yersinia ruckeri*. Copper exposure at 7 and 10  $\mu\text{g}$  per l for 96 h caused more fish to die of infection than control fish (no copper). Infection susceptibility increased with time of exposure to a single dosage of copper (10  $\mu\text{g}$  per l), reaching a maximum at 48 h. Lowering the copper concentration to 5  $\mu\text{g}$  per l caused the infection susceptibility to occur at 24 h. The infectious dose of *Y. ruckeri* was lower in fish exposed to 10  $\mu\text{g}$  per l copper for 48 h than control fish. (Author). 001124.

000533

Konagaya, S.

1980. Jellification and protease activity of yellowfin sole muscle in association with a myxosporidian parasite. Bull. Jpn. Soc. Sci. Fish. 46(8):1019-1026. (Tokai Reg. Fish. Res. Lab. Kachidoki-5, Chuo-ku, Tokyo 104, Japan.).

Numerous spores of a myxosporidian parasite, tentatively classified as the genus *Kudoa*, were found in many of the muscle specimens of the yellowfin sole *Limanda aspera* which were caught in the Bering Sea.

The muscle infected heavily with the parasite, displayed a considerably high protease activity. Such muscle was observed to be easily jellified when left standing at room temperature.

Two types of protease occurred in the heavily infected muscle, one designated protease A hydrolyzing hemoglobin optimally at pH 3 and the other designated protease B casein optimally at pH 6.5 under the conditions applied. Protease B activity was not always detected in less infected muscles. The muscle containing both proteases was jellified very rapidly. Both protease activities were strongly inhibited by  $\text{Hg}^{+2}$ , PCMB or leupeptin, indicating them to be of thiol enzyme.

It was concluded from these results that the proteases were produced by the parasite and responsible for the jellification of the muscle. (Author). 001011. (Paper in Japanese)

000534

Kusuda, R., Fukuda, Y.

1980. Agglutinating antibody titers and serum protein changes of yellowtail after immunization with *Pasteurella piscicida* cells. Bull. Jpn. Soc. Sci. Fish. 46(7):801-807. (Fish Dis. Lab. Fac. Agric. Kochi Univ. Nankoku, Kochi 783, Japan.).

Development of vaccine against pseudotuberculosis, caused by *Pasteurella piscicida*, in cultured yellowtail, *Seriola quinqueradiata*, has been attempted, yet few studies of humoral aspect of the immune response in yellowtail have been reported. The present study was designed to obtain some information about agglutinating antibody titers and serum protein changes of cultured yellowtail immunized by intraperitoneal injection with formalin-killed *P. piscicida* cells in Freund's complete adjuvant.

Agglutinating antibody titers in immunized fish sera increased ranging from 1:256 to 1:2048 5 weeks after immunization. Serum protein changes after immunization were observed by electrophoretic analyses; cellulose acetate electrophoresis, polyacrylamide gel disc electrophoresis and agar gel immunoelectrophoresis. Both immunized and control fish sera were separated into four fractions by gel filtration on Sephadex G-200 and agglutinating antibody activity was found in the first fraction of immunized one. This fraction included the protein, more than approximately 800,000 in molecular weight, the changes of which were observed in number and density of precipitin lines formed in  $\alpha$ - $\beta$  globulin region in agar gel immunoelectrophoresis after immunization.

It is concluded that production of agglutinating antibody results in serum protein changes, observed in agar gel immunoelectrophoresis, after



parenteral immunization. (Authors). 001054.  
(Paper in Japanese)

000535

Lallier, R., Boulanger, Y., Olivier, G.

1980. Difference in virulence of *Aeromonas hydrophila* and *Aeromonas sobria* in rainbow trout. Prog. Fish-Cult. 42(4):199-200. (Dep. Pathol. Microbiol. Fac. Vet. Med. Univ. Montreal, St. Hyacinthe, Que. Canada J2S 7C6.).

Recent taxonomic studies indicate that motile Aeromonads are comprised of two species, *Aeromonas hydrophila* and *A. sobria*. Biochemical differentiation of the two species is based on esculin hydrolysis, and salicin and arabinose fermentation by *A. hydrophila*, and by the failure of *A. sobria* to metabolize any of the compounds. Experimental challenge of rainbow trout at 18°C showed that intramuscular injection of 10<sup>8</sup> *A. hydrophila* cells killed all trout within 48 h. In contrast, 10<sup>8</sup> *A. sobria* cells were required to produce the same mortality. At 10°C a minimum of 10<sup>7</sup> *A. hydrophila* and 10<sup>8</sup> *A. sobria* cells were required to kill all trout within 72 h. Additionally, *A. hydrophila* was present in trout kidneys 5 days after injection, but *A. sobria* was not present at 3 days post-injection. The study showed that classification of motile Aeromonads into two species was useful in separating virulent *A. hydrophila* from weakly virulent *A. sobria*. (G. L. Bullock). 001063.

000536

Lannan, C. N.

1979. Diagnosis of parasitic diseases: whirling disease and ceratomyxosis. Pages 29-31 in J. L. Fryer, J. S. Rohovec, E. F. Pulford, R. E. Olson, D. P. Ransom, J. R. Winton, C. N. Lannan, R. P. Hedrick, and W. J. Groberg, eds. Proceedings from a conference on disease inspection and certification of fish and fish eggs. Oregon State Univ. Sea Grant Coll. Progr. Cent. Oregon. (Mar. Sci. Cent. Oregon State Univ. Corvallis, Oreg. 97331.).

001116.

000537

Lowe-Jinde, L.

1980. Observations of rainbow trout, *Salmo gairdneri* Richardson, infected with *Cryptobia salmostica*. J. Fish Biol. 17(1):23-30. (Dep.

Zool. Univ. Guelph, Guelph, Ont. Canada N1G 2W1.).

Rainbow trout, *Salmo gairdneri*, were experimentally infected with *Cryptobia salmostica*. The parasitaemia was associated with increases in the size of the spleen, liver, and heart (% body weight). The splenomegaly was pronounced and was often 600-fold larger. The amounts of blood lactic acid and lactic dehydrogenase in the infected and control fish were similar. However, glycogen levels of the liver, heart, and epaxial muscle declined. Liver glycogen levels were most affected and decreased to values which represented 20% of the control values. The pattern of the glycogen levels of the liver, heart, and epaxial muscle declined to rise to normal values by day 56 post-inoculation. Thus, the glycogen levels both paralleled the acute parasitaemia and the subsequent partial recovery of the infected fish as they tolerated a low chronic parasitaemia. (Author). 001048

000538

Maisse, G., Dorson, M., Torchy, C.

1980. Ultraviolet inactivation of two pathogenic salmonid viruses (IPN virus and VHS virus). (Inactivation de deux virus pathogenes pour les salmonides (virus de la Necrose Pancreatique Infectieuse et de la Septicemie Hemorragique Virale) par les rayons ultraviolets.) Bull. Fr. Piscic. 278(3):34-40. (Lab. Physiol. Poissons, INRA, Rennes, France.).

Infectious pancreatic necrosis virus (IPNV) and viral hemorrhagic septicemia virus (VHSV) were diluted in clear tap water and subsequently inactivated by passing through a laboratory made UV system at various flow rates.

Titration of outflowing samples allowed calculation of a LD 90 of 10,000  $\mu$ . W.s. cm<sup>-2</sup> for VHSV. Infectious pancreatic necrosis virus proved much more resistant, with a LD 80 of 330,000  $\mu$ . W.s. cm<sup>-2</sup>.

Under trout farming conditions, UV protection of hatcheries against European salmonid viruses could be achieved only in the case of VHSV and not against IPNV. (Authors). 001043. (Paper in French)

000539

Maugle, P. D., Meade, T. L.

1980. Use of specific-ion electrode for the determination of un-ionized ammonia in fish blood.

Prog. Fish-Cult. 42(4):224-228. (Dep. Anim. Sci. Univ. Rhode Island, Kingston, R. I. 02881.).

An accurate and simple direct-injection method for the determination of whole blood ammonia in fish uses an ammonia-specific electrode fitted with a flow-through cap (Orion Res. Inc.). Blood from the dorsal aorta of 2-year-old steelhead trout (*Salmo gairdneri*) and coho salmon (*Oncorhynchus kisutch*) was obtained without contact with air and injected directly into the micro-flow-through cap for ammonia determination without prior treatment. To determine whether the results obtained by the Conway diffusion and the direct-injection methods were significantly different, we measured whole blood samples from steelhead trout simultaneously; the Conway method gave values 42% higher than the direct-injection method and a Student's *t*-test verified the ammonia levels were significantly higher ( $P < 0.005$ ) by the Conway diffusion method. The difference was believed to be due to the base hydrolysis of labile nitrogen-containing compounds in fish blood. Test comparison of the direct-injection method and a plasma ammonium method revealed a significant increase ( $P < 0.05$ ) in ammonium levels attributed to the plasma ammonium method. (Authors). 001030

000540

Mayberry, L. F., Marchiondo, A. A., Ubelaker, J. E., Kazic, D.

1979. *Rhabdospora thelohani* Laguesse, 1895 (Apicomplexa): new host and geographic records with taxonomic considerations. J. Protozool. 26(2):168-178. (Dep. Biol. New Mexico State Univ. Las Cruces, N. M. 88003.).

New fish species and geographic records for *Rhabdospora thelohani* Laguesse, 1895 (rodlet cells) are presented. Additionally, the ultrastructure of *R. thelohani* in *Alburnoides bipunctatus ohridanus* Karaman, *Borostomias antarcticus* (Lonnberg), *Leuciscus cephalus albus* Bonaparte and *Rutilus rubilio* (Bonaparte) is compared with that reported by other authors and with members of subphylum Apicomplexa. The ultrastructure of *R. thelohani* was similar in all the fish species examined; however, the organism was not present in all members of any single species and had intertissue density variations. *Rhabdospora thelohani* is pyriform, averaging in size  $7 \times 12 \mu\text{m}$ , with a basal nucleus. The surface complex is composed of a layer (0.5  $\mu\text{m}$  diameter) formed by microfilaments (9.3 nm) and an outer trilaminar membrane (9.3 nm). The cytoplasm contains structures identical to rhoptries, micronemes and subpellicular microtubules. Mitochondria, Golgi apparatus, and rough endoplasmic reticulum were not observed, although free ribosomes were present and ar-

ranged in a vesicular pattern. The observations suggest that the organism moves between cells of epithelial layers and is either released into a lumen intact or passively or actively discharges its contents into a lumen. Results from this study indicate that *R. thelohani* should be considered a member of Apicomplexa unless definitive evidence is presented to the contrary. (Authors). 000968.

000541

McKenzie, K.

1980. First report of the plerocercus of *Grillotia angeli* Dollfus 1969 (Cestoda: Trypanorhyncha). J. Parasitol. 66(1):175-176. (Dep. Agric. Fish. Scotland, Mar. Lab. P. O. Box 101, Victoria Road, Aberdeen, Scotland.).

Plerocerci of *Grillotia angeli* were found in 14 of 118 mackerel from Cornwall. Key features are described and illustrated. (Ken Wolf). 000970.

000542

McVicar, A. H., Wootten, R.

1980. Disease in farmed juvenile Atlantic salmon caused by *Dermocystidium* sp. Pages 165-173 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (DAFS, Mar. Lab. Victoria Rd. Aberdeen, Scotland.).

001158.

000543

Meier, W., Jorgensen, P. E. V.

1980. Isolation of VHS virus from pike fry (*Esox lucius*) with hemorrhagic symptoms. Pages 8-17 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Untersuchungsstelle Fischkrankheiten, Vet. bakt. Inst. Univ. Bern, Langgasstr. 122, CH-3012 Bern, Switzerland.).

001133

000544

Michel, C.

1980. Development of bacteria in fish and in water during a standardized experimental infection of rainbow trout (*Salmo gairdneri*) with *Aer-*

*omonas salmonicida*. Pages 94-97 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Lab. Ichthyopathol. Stn. Virol. Immunol. 78850 Thiverval-Grignon, France.).

001147.

000545

Middlebrooks, B. L., Mak, P. C., Ellender, R. D.

1980. Properties of an established cell line from the Atlantic croaker (*Micropogon undulatus*) (40945). Proc. Soc. Exp. Biol. Med. 165(1):123-128. (Dep. Microbiol. Univ. Southern Mississippi, Hattiesburg, Miss. 39401.).

A fibroblast-like cell line, CrF, has been developed from muscle tissue of the marine teleost fish *Micropogon undulatus* (the Atlantic croaker). The line was initiated by subculture of cells from explanted tissue of a single male fish. The growth medium employed contained L-15 basal medium supplemented with 15% fetal calf serum, 1 to 5% human serum, and antibiotic-antimycotic mixture. The line was characterized fully and carried through 85 subcultures. Karyological analysis showed the line to be heteroploid, with a modal chromosome number of 48 at low passage levels and 49 at high levels. All chromosomes are small and telocentric. Growth characteristics were carried out under varying conditions of incubation. Optimal growth occurred at 26 to 32°C in growth medium adjusted to a NaCl molarity of 0.147 to 0.177 M (although a wider range was tolerated). A plating efficiency of up to 30% and freeze viability rates of 65 to 70% were observed. The line was shown to be susceptible to lymphocystis virus, but refractory to infectious pancreatic necrosis virus, spring viremia of carp virus, channel catfish virus, vesicular stomatitis virus, and eastern equine encephalitis virus. The identity of species of origin was confirmed by the cytotoxic antibody dye exclusion test, and the absence of microbial contamination was determined by inoculation of appropriate microbial growth media. (Authors). 001041.

000546

Mills, C. A.

1980. Temperature-dependent survival and reproduction within populations of the ectoparasitic digenean *Transversotrema patialense* on the fish host. Parasitology 81(1):91-102. (Zool. Dep. King's Coll. London Univ. London WC2R 2LS, England.).

The reproduction and survival of the ectoparasitic digenean *Transversotrema patialense* on the fish host *Brachydanio rerio* are shown to be temperature-dependent. Survival is reduced by any deviation from an optimum temperature of approximately 23°C. With increasing temperature the rate of egg production per surviving fluke rises progressively faster to a higher peak up to 29°C but falls to zero by 35°C. The span of egg production varies closely with the life-span of the parasite at each temperature. The optimum temperature for the total number of eggs produced by each cohort of parasites is also 23°C. This number is a function of both adult parasite survival and the rate of egg output. (Author). 001083

000547

Mizunashi, F., Miyazaki, T., Funahashi, N., Kubota, S. S.

1979. Studies on tumor and tumor-like nodules of fishes—II. Nephroblastoma of rainbow trout. Fish Pathol. 13(4):173-178. (Dep. Fish. Fac. Fish. Mie Univ. Edobashi, Tsu, Mie, Japan.).

The present authors histopathologically examined renal tumors of two 3-year old rainbow trouts, which were reared in Samegai trout culture station in 1974. The tumor consisted of a large number of neoplastic nodules and around which neoplastic islets were scattered in the hematopoietic tissue. The histopathological examination revealed that they were nephroblastoma (known as Wilms' tumor) with two different characteristics.

Type I: Neoplastic nodules were composed of a large number of smooth muscle cells in differentiations, well-differentiated renal tubular epithelial cells and a small number of undifferentiated mesenchymal cells with argyrophilic fine fibers. Mitotic figures were frequently observed in smooth muscle fibers and mesenchymal cells.

Type II: Neoplastic nodules were composed of a large number of undifferentiated mesenchymal cells and islets of immature renal tubular epithelial cells. Mitotic figures were numerous in both types of cells.

Metastatic lesions were not observed in both cases. (Authors). 000967. (Paper in Japanese)

000548

Modin, J. C.

1981. *Microsporidium rhabdophilia* n. sp. from rodlet cells of salmonid fishes. J. Fish Dis.

4(3):203-211. (Inland Fish. Branch, Dep. Fish Game, Fish Dis. Lab. Rancho Cordova, Calif. 95670.).

A microsporidian parasite, *Microsporidium rhabdophilia* n. sp. is described from rodlet cells of salmonid fishes. Chinook salmon, *Oncorhynchus tshawytscha*, coho salmon, *Oncorhynchus kisutch*, steelhead rainbow trout, *Salmo gairdnerii gairdnerii*, and various strains of domesticated rainbow trout were found infected. In living wet mount phase-contrast observations of various tissues, 16 mature spores could be seen infecting the nucleus of rodlet cells. The number of spores infecting each nucleus generally numbered 16 and spores were not found in any cell or organelle other than the nucleus of the rodlet cell. All observations were limited to California hatchery reared fish. (Author). 001099.

000549

Molnar, K.

1980. Sphaerosporosis, a new kidney disease of the common carp. Pages 157-164 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Vet. Med. Res. Inst. Hungarian Acad. Sci. Budapest, Hungary.).

001157.

000550

Mori, M.

1980. Studies on the phagocytic system in goldfish-I. Phagocytosis of intraperitoneally injected carbon particles. Fish Pathol. 15(1):25-30. (Tokyo Metrop. Fish. Exp. Stn. Katsushika-ku, Tokyo, Japan.).

The phagocytic system in goldfish was studied through intraperitoneal injection with India ink. Fish were killed at intervals ranging from 30 min to 50 days after injection. Histological research was performed on spleen, kidney, heart, liver, gills, and blood.

On the first day after injection, the spleen and kidney became black. Phagocytosis of carbon particles was performed from the first day after injection by the sheath cells in the sheathed artery of the spleen, by the reticuloendothelial cells throughout the hematopoietic tissue of the kidney, and by the endothelial cells in the ventricle of the heart. Carbon phagocytizing macrophages in the kidney and spleen formed aggregates within pre-existing aggregates of melano-macrophage on the fourth day after injection. Those aggregates were

observed for 50 days. There was no phagocytosis of carbon particles observed in the liver and gills.

Two types of mononuclear phagocytes phagocytizing carbon particles were observed in smears of blood. The large phagocytes measured between 14 and 16  $\mu$  in diameter and the nucleus occupied almost half of the cell. The small phagocytes measured between 6 and 7  $\mu$  in diameter and the nucleus occupied almost all of the cell. Although the small phagocytes were observed in smears during the period from the first day to the thirty-sixth day after injection, the large ones were only observed from the first day to the seventh day.

The significance of the phagocytic system in fish is discussed. (Author). 001047. (Paper in Japanese)

000551

Morrison, C., Cornick, J., Shum, G., Zwicker, B.

1981. Microbiology and histopathology of saddleback disease of underyearling Atlantic salmon, *Salmo salar* L. J. Fish Dis. 4(3):243-258. (Fish. Environ. Sci. Dep. Fish. Oceans, Halifax Lab. Halifax, N.S. Canada B3J 2S7.).

Heavy mortalities of underyearling Atlantic salmon parr have occurred at the Mactaquac Fish Culture Station in New Brunswick as the result of saddleback disease. The organism causing this lesion was isolated and identified as *Flexibacter columnaris*. This bacterium was transmitted to other salmon parr, where it produced the typical saddle lesion from which it was re-isolated. The condition was more readily transmitted at 20°C than at 15°C. Transmission required entrance to the dermis through a break in the epidermal surface and was unsuccessful in intact fish. The morphology of the saddleback isolate and its histopathological effect on the fish tissues is described. *Flexibacter columnaris* appeared to be restricted to the dermis and underlying muscle of the saddle area when histological techniques were used, although it was also isolated from the kidneys of some affected fish. The gills, kidney, and other organs of the fish did not seem to be affected by the presence of *F. columnaris*. (Authors). 001103.

000552

Morrison, C. M., Sprague, V.

1981. Electron microscopical study of a new genus and new species of microsporidia in the gills of Atlantic cod *Gadus morhua* L. J. Fish Dis. 4(1):15-32. (Fish. Environ. Sci. Dep. Fish.



Oceans, Halifax Lab. P. O. Box 550, Halifax, N. S. Canada B3J 2S7.).

A microsporidium, forming xenoparasitic complexes (xenomas) of the cell-hypertrophy tumor type, was found in the gills of the Atlantic cod *Gadus morhua* L. and studied with the electron microscope. It seemed to be similar to *Nosema branchiale* Nemecek, 1911, in the haddock *Melanogrammus aeglefinus* (L.) except in size of spore. The xenoma (cyst) was basically like the *Glugea* cyst and the parasite had some other characters in common with *Glugea*; it was aplanosporoblastic, unikaryotic, disporoblastic and underwent partial development in parasitophorous vacuoles. It differed from *Glugea* in lacking plasmodial stages, producing usually 1 or 2 spores (rather than 16) in a vacuole, showing no distinct tendency for different stages to occur in different zones of the cyst and having tubules in the parasitophorous vacuoles. The name *Loma morhua* n. g. n. sp. (type) was proposed and the genus assigned to the family Glugeidae Thelohan, 1892. The parasite of haddock gill was transferred to the new genus, becoming *L. branchialis* (Nemecek, 1911) n. comb. (Authors). 001123.

000553

Mulcahy, D. M., Tebbitt, G. L., Groberg, W. J. Jr., McMichael, J. S., Winton, J. R., Hedrick, R. P., Philippon-Fried, M., Pilcher, K. S., Fryer, J. L.

1980. The occurrence and distribution of salmonid viruses in Oregon. *Oreg. Agric. Exp. Stn. Tech. Pap. No. 5504*, 1980. 71 pp. (Dep. Microbiol. Oregon State Univ. Corvallis, Oreg. 97331.).

Salmonid populations in Oregon hatcheries, rivers and lakes have been examined extensively for the presence of viruses pathogenic for these species. Cell culture methods were employed that permitted the isolation of such agents from fish tissues and their identification. Two viruses have been isolated during the course of this investigation. The first of these recovered was found to cause an epizootic among juvenile sockeye salmon (*Oncorhynchus nerka*) at the Oakridge Salmon Hatchery in 1958. The disease that the virus causes is now known as infectious hematopoietic necrosis (IHN).

The second virus found in Oregon's salmonids causes the disease known as infectious pancreatic necrosis (IPN). It was isolated in 1971 from adult cutthroat trout (*Salmo clarki*) resident in a small creek, and from adult coho salmon (*Oncorhynchus kisutch*) being spawned at Bonneville Hatchery on

the Columbia River. In both cases the fish were asymptomatic carriers.

Evidence for the presence of a third fish virus was found in the erythrocytes of spawning adult chum salmon (*Oncorhynchus keta*) and Pacific herring (*Clupea harengus pallasii*) taken in waters along the Oregon coast. This virus has not been isolated in cell cultures. The associated disease is now referred to as viral erythrocytic necrosis (VEN).

*Herpesvirus salmonis*, first isolated from rainbow trout (*Salmo gairdneri*) in the Pacific Northwest, has never been found among any fish population examined in Oregon.

Recommendations for the control of IHN and IPN viruses are included in this report. (Authors). 001097.

000554

Munn, C. B.

1980. Production and properties of a haemolytic toxin by *Vibrio anguillarum*. Pages 69-74 in Ahne, W. ed. *Fish diseases. Third COPRAQ session*. Springer-Verlag, Berlin. (Plymouth Polytech. Plymouth PL4 8AA, England.).

001142.

000555

Munro, A. L. S., Hastings, T. S., Ellis, A. E., Liversidge, J.

1980. Studies on an ichthyotoxic material produced extracellularly by the furunculosis bacterium *Aeromonas salmonicida*. Pages 98-106 in Ahne, W. ed. *Fish diseases. Third COPRAQ Session*. Springer-Verlag, Berlin. (Mar. Lab. Aberdeen, Scotland.).

001148.

000556

Murchelano, R. A., Edwards, R. L.

1981. An erythrophoroma in ornamental carp, *Cyprinus carpio* L. *J. Fish Dis.* 4(3):265-268. (Natl. Mar. Fish. Serv. Northeast Fish. Cent. Oxford Lab. Oxford, Md. 21654.).

Representative tissues were sampled by biopsy then fixed, sectioned and stained for histopathological examination. Based on morphology and loca-



tion within red pigmented areas of skin, the neoplasms were diagnosed as erythrophoroma with some evidence of malignance. Representative tissue sections are described, illustrated, and on deposit with the Registry of Tumors of Lower Animals as RTLA 2052. Electron microscopy was not reported. (Ken Wolf). 001105.

000557

Muzzall, P. M.

1980. Ecology and seasonal abundance of three acanthocephalan species infecting white suckers in SE New Hampshire. J. Parasitol. 66(1):127-133. (Dep. Zool. Univ. New Hampshire, Durham, N. H. 03824.).

The occurrence and host-parasite relationships of three acanthocephalan species parasitizing white suckers, *Catostomus commersoni* (Lacepede), from two rivers in southeastern New Hampshire were studied. The mean intensity of *Neoechinorhynchus cristatus* Lynch 1936 was highest in Oyster River white suckers during fall 1975 and 1976. Conversely, the mean intensity of *Pomphorhynchus bulbocolli* Linkins in Van Cleave 1919 was highest in spring and summer 1975, spring 1976 and winter 1976-1977. This seasonal pattern coincided with the movement of large suckers into and out of the Oyster River sampling area, and the subsequent examination of large and small hosts. *Octospinifer macilentus* Van Cleave 1919 and *P. bulbocolli* infected a large number of Bellamy River white suckers, and did not exhibit seasonal infection patterns.

All three acanthocephalan species occurred in the mid- to posterior intestinal area. Significant correlation coefficients suggested that prevalence and/or mean intensity of *P. macilentus* and *P. bulbocolli* (both localities) increased as did fish length. The prevalence and mean intensity of *N. cristatus* were highest in fish between 5.0 and 14.9 cm in length. Male and female white suckers had similar prevalences and mean intensities. (Author). 000977

000558

Neumann, W., Ploger, W.

1980. Examination in resistance tests of some strains of the *Aeromonas hydrophila punctata* group isolated from carp. Pages 90-93 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Tiergesundheitsamt der Landwirtschaftskammer Weser-

Ems, Postfach 2549, D-2900 Oldenburg, Fed. Rep. Germany.).

001146.

000559

Nicholson, B. L.

1980. Growth of fish cell lines on microcarriers. Appl. Environ. Microbiol. 39(2):394-397. (Dep. Microbiol. Migratory Fish Res. Inst. Univ. Maine, Orono, Maine 04469.).

Microcarrier beads were evaluated as substrates for the propagation of five anchorage-dependent fish cell lines. Growth of rainbow trout gonad (RTG-2) and Atlantic salmon cells was limited on microcarriers maintained in suspension. However, stationary microcarriers were suitable substrates for the growth of RTG-2, AS, chinook salmon embryo (CHSE-214), and fathead minnow cells. Cell yields ranges from  $2 \times 10^6$  to  $2.9 \times 10^6$  cells per ml, representing 7- to 10-fold increases over the initial cell concentrations. The yield of new RTG-2 cells per unit volume of growth medium was 2.8 times greater in microcarrier cultures than in standard monolayer cultures. Northern pike cells failed to grow on microcarriers. Yields of infectious pancreatic necrosis virus propagated in microcarrier cultures of RTG-2 cells were more than twice the yields in standard monolayer cultures. The greater economy of microcarrier cultures in terms of growth vessel and medium requirements holds great promise for the large-scale production of anchorage-dependent fish cell cultures and fish viruses. (Author). 001044.

000560

Ogawa, K.

1980. Recent studies on mongeneans. Fish Pathol. 15(1):57-58. (Fac. Agric. Univ. Tokyo, Tokyo 113, Japan.).

001031. (Paper in Japanese)

000561

Olson, R. E.

1979. Review of North American fish disease control regulations. Pages 10-18 in J. L. Fryer, J. S. Rohovec, E. F. Pulford, R. E. Olson, D. P. Ransom, J. R. Winton, C. N. Lannan, R. P. Hedrick, and W. J. Groberg, eds. Proceedings from a conference on disease inspection and cer-

tification of fish and fish eggs. Oreg. State Univ. Sea Grant Coll. Progr. (Dep. Zool. Mar. Sci. Cent. Oregon State Univ. Corvallis, Oreg. 97331.).

001112.

000562

Palmer, R., Smith, P. R.

1980. Studies on vaccination of Atlantic salmon against furunculosis. Pages 107-112 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Dep. Microbiol. Univ. Coll. Galway, Ireland.).

001149.

000563

Paperna, I., Sabnai, I.

1980. Epitheliocystis disease in fishes. Pages 228-234 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (H. Steinitz Mar. Biol. Lab. Eilat, Israel.).

001169.

000564

Peters, G., Delventhal, H., Klinger, H.

1980. Physiological and morphological effects of social stress on the eel, *Anguilla anguilla* L. Pages 225-227 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Inst. Hydrobiol. Fischereiwiss. Univ. Hamburg, Olbersweg 24, D-2000 Hamburg 50, Fed. Rep. Germany.).

See also Fish Health News 9(3), 1980 for abstract of published paper. 001168.

000565

Pickering, A. D., Christie, P.

1980. Sexual differences in the incidence and severity of extoparasitic infestation of the brown trout, *Salmo trutta* L. J. Fish Biol. 16(6):669-683. (Freshw. Biol. Assoc. Ferry House, Far Sawrey, Nr. Ambleside, Cumbria LA22 0LP, England.).

Hatchery-reared and wild brown trout, *Salmo trutta* L. were examined for skin ectoparasites during their spawning period in 1977 and 1978. A total of eight genera of parasites, comprising five ciliates, one flagellate, one monogenean and one parasitic fungus, were identified with as many as five different genera occurring on a single fish. Sexually mature male fish were more frequently or more severely infested by species of *Ichthyophthirius*, *Scyphidia*, *Gyrodactylus* and *Saprolegnia* than were immature fish of either sex or mature female fish. The differences in ectoparasitic loading could not be correlated with known seasonal changes in the mucus-producing potential of the epidermis. These findings are discussed in relation to the defense mechanisms of teleost fish and to some of the endocrinological changes that occur in salmonid fish during the spawning season. (Authors). 001027.

000566

Pol, J. M. A., Bootsma, R., Berg-Blommaert, J. M.

1980. Pathogenesis of carp erythrodermatitis (CE): role of bacterial endoand exotoxin. Pages 120-125 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Dep. Spec. Anim. Pathol. Utrecht, The Netherlands.).

001151.

000567

Pomales, A. D., Williams E. H. Jr.

1980. Yearly parasite variation in the temperate centrarchid, *Micropterus salmoides* (Lacepede), largemouth bass, twenty-eight years after introduction into a tropical environment. J. Parasitol. 66(1):81. (Dep. Mar. Sci. Univ. Puerto Rico, Mayaguez, Puerto Rico 00708.).

At monthly intervals during a 1 year period, five fish were taken from Puerto Rican waters and examined for monogenetic trematodes. (Ken Wolf). 000975.

000568

Pulford, E.

1979. Fish disease guidelines for the producers of cultivated fish in Oregon. Pages 19-21 in J. L. Fryer, J. S. Rohovec, E. F. Pulford, R. E. Olson, D. P. Ransom, J. R. Winton, C. N.

Lannan, R. P. Hedrick, and W. J. Groberg, eds. Proceedings from a conference on disease inspection and certification of fish and fish eggs. Oreg. State Univ. Sea Grant Coll. Progr. Fish Wildl. (Oregon Dep. Fish Wildl. P. O. Box 3503, Portland, Oreg. 97208.).

001113.

000569

Radabaugh, D. C.

1980. Changes in minnow, *Pimephales promelas* Rafinesque, schooling behaviour associated with infections of brain-encysted larvae of the fluke, *Ornithodiplostomum ptychocheilus*. J. Fish Biol. 16(6):621-628. (Dep. Zool. Ohio Wesleyan Univ. Delaware, Ohio 43015.).

The schooling behaviour of unparasitized fathead minnows, *Pimephales promelas* Rafinesque, was compared to that of minnows infected with brain-dwelling metacercariae of the fluke, *Ornithodiplostomum ptychocheilus* (Faust). Laboratory results showed that schools of infected fish divided more frequently, were less compact, and occupied positions closer to the water surface than control schools. These results are discussed with reference to the possibility that this larval parasite manipulates minnow behaviour to increase host vulnerability to predation. (Author). 001028.

000570

Radhakrishnan, S., Nair, N. B.

1981. Histopathology of the infestation of *Diodon hystrix* L. by *Peniculisa wilsoni* Radhakrishnan (Copepoda: Lernaecoceridae). J. Fish Dis. 4(1):83-87. (Dep. Aquatic Biol. Fish. Univ. Kerala, Trivandrum 695 007, India.).

Infested fins of the discus fish were found to have marked hyperplasia of soft tissues at the site of copepod attachment. Connective and epidermal tissues both proliferated and the tumorous growth surrounded the head and neck of the parasite. The findings are compared with those of other copepod infestations. (Ken Wolf). 001129.

000571

Ransom, D.

1979. Sampling and necropsy of fish for parasitic and bacterial diseases. Pages 23-24 in J. L. Fryer, J. S. Rohovec, E. F. Pulford, R. E. Olson,

D. P. Ransom, J. R. Winton, C. N. Lannan, R. P. Hedrick, and W. J. Groberg, eds. Proceedings from a conference on disease inspection and certification of fish and fish eggs. Oreg. State Univ. Sea Grant Coll. Progr. (Dep. Microbiol. Oregon State Univ. Corvallis, Oreg. 97331.).

001114.

000572

Reichenbach-Klinke, H. H.

1980. Contributions to the taxonomy of the genus *Diplozoon* von Nordmann, 1832. Pages 235-247 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Inst. Zool. Hydrobiol. Univ. Munich, Kaulbachstrasse 37, D-8000 Munich, Fed. Rep. Germany.).

001170

000573

Richards, R. H.

1980. Observations on vibriosis in cultured flatfish. Pages 75-81 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Inst. Aquacult. Univ. Stirling, Stirling FK9 4LA, Scotland.).

001143.

000574

Rijkers, G. T., Frederix-Wolters, E. M. H., Van Muiswinkel, W. B.

1980. The immune system of cyprinid fish. Kinetics and temperature dependence of antibody-producing cells in carp (*Cyprinus carpio*). Immunology 41(1):91-97. (Dep. Exp. Anim. Morphol. Cell Biol. Agric. Univ. Wageningen, The Netherlands.).

After immunization of carp with sheep red blood cells, the spleen accounts for only 5% of the total number of plaque-forming cells (PFC). In addition, thymus, peripheral blood, and heart contained low numbers of PFC (< 0.5, 1 and 0.5%, respectively). Pronephros and mesonephros were the major antibody-forming organs (53 and 40% of total PFC, respectively). The temperature dependence of the antibody-forming cell response in spleen, pronephros, and mesonephros was studied in animals kept at 12-24°C. Lowering temperatures induced a delay in the peak of the primary response but had no

effect on the magnitude of the response. The temperature-peak day relationship indicated that there are steps in the primary immune response of carp differing in temperature sensitivity. The anamnestic character of the secondary response was clearly demonstrated at 24 and 20°C but lost at 18°C. (Authors). 001058.

000575

Roald, S. O., Armstrong, D., Landsverk, T.

1981. Histochemical, fluorescent and electron microscopical appearance of hepatocellular ceroidosis in the Atlantic salmon *Salmo salar* L. J. Fish Dis. 4(1):1-14. (Natl. Vet. Inst. Postboks 8156, Oslo 1, Norway.).

In this work it is established that a close relationship exists between the feeding of rancid feed (containing high amounts of lipid peroxides and  $\alpha$ ,  $\beta$  unsaturated aldehydes) and lipid liver degeneration (LLD) in fish. The main feature of the disease is a large accumulation of ceroid in hepatocytes, giving positive histochemical staining reactions with a number of selective stains. Tissues also reacted strongly for lipid peroxides and fluoresced a bright yellow-green at 450 nm. This is the first report on the ultrastructure of ceroid in LLD. The accumulations consist of bodies containing cholesterol or cholesterol ester crystals and inclusions with membranous profiles. The latter type of inclusion is considered to be representative of ceroid. (Authors). 001122.

000576

Roald, S. O., Hastein, T.

1980. Infection with an Acinetobacter-like bacterium in Atlantic salmon (*Salmo salar*) broodfish. Pages 154-156 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Natl. Vet. Inst. Postbox 8156, Dep. Oslo 1, Norway.).

001156.

000577

Robinson, G. L., Jahn, L. A.

1980. Some observations of fish parasites in pool 20, Mississippi River. Trans. Am. Microsc. Soc. 99(2):206-212. (Dep. Biol. Sci. Western Illinois Univ. Macomb, Ill. 61455.).

Fish parasites were collected in the upper 8 km of pool 20, Mississippi River, near Hamilton, Illinois from March through October 1977 and from June through September 1978. A total of 242 fish was taken, 158 (65%) of which were infected with one or more parasites. Fish hosts represented 29 species in 14 families, and parasites (excluding protozoans) represented 38 species in 5 phyla. Nematodes were the most abundant parasites, being found in 56% of the infected hosts, followed by trematodes (38%), cestodes (33%), leeches (13%), copepods (9%), and acanthocephalans (6%). The nematode *Camallanus oxycephalus* was the most common parasite, being found in 16 hosts. Three larval parasites were found; these were the cestode *Proteocephalus*, and the trematodes *Posthodiplostomum minimum centrarchi* (white grub) and *Clinostomum marginatum* (yellow grub). The following fishes were new host records for parasites: *Scaphirhynchus platyrhynchus*, *Anguilla rostrata*, *Carpionodes carpio*, *Carpionodes cyprinus*, *Ictiobus bubalus*, *Moxostoma macrolepidotum*, *Alosa chrysochloris*, *Hiodon alosoides*, *Pylodictis olivaris*, *Morone mississippiensis*, and *Morone chrysops*. (Authors). 001079.

000578

Rohovec, J.

1979. Review of international regulations concerning fish health. Pages 7-9 in J. L. Fryer, J. S. Rohovec, E. F. Pulford, R. E. Olson, D. P. Ransom, J. R. Winton, C. N. Lannan, R. P. Hedrick, and W. J. Groberg, eds. Proceedings from a conference on disease inspection and certification of fish and fish eggs. Oreg. State Univ. Sea Grant Coll. Program. (Dep. Microbiol. Oregon State Univ. Corvallis, Oreg. 97331.).

001111.

000579

Rosen, P.

1980. Ultraviolet carcinogenesis in the teleost fish, *Poecilia formosa*. Med. Hypotheses 6:1057-1061. (Biol. Dep. Brookhaven Natl. Lab. Upton, L. I. N. Y. 11973.).

A calculation is made of the fraction of a population of *Poecilia formosa*, that develop ultraviolet induced tumors and the result compared with the experimental data. Reasonable correlation is obtained. (Author). 001088.



000580

Sanders, W. J., Wolinsky, E.

1980. In vitro susceptibility of *Mycobacterium marinum* to eight antimicrobial agents. *Antimicrob. Agents Chemother.* 18(4):529-531. (Div. Infect. Dis. Dep. Med. Cleveland Metrop. Gen. Hosp. Cleveland, Ohio 44109.).

The in vitro susceptibilities of 16 *Mycobacterium marinum* strains to eight antimicrobial agents were determined by the agar dilution technique. The most active drugs were amikacin and kanamycin. Tetracycline, doxycycline, and minocycline were inhibitory, predominantly at concentrations slightly below the expected blood and tissue levels. Trimethoprim-sulfamethoxazole and erythromycin demonstrated activity only at concentrations greater than those usually attained in serum and tissues. Gentamicin was relatively inactive. (Authors). 001061.

000581

Sarig, S., Bejeranao, I.

1980. Bacterial stress caused infections of silver carp and *Sarotherodon aureus* in fish ponds and their control. Page 224 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Lab. Res. Fish Dis. Nir-David, 19150, Israel.).

(Abstract only). 001167.

000582

Schlotfeldt, H. J.

1980. The increase of nephrocalcinosis (NC) in rainbow trout in intensive aquaculture. Pages 198-205 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Fish Dis. Contr. Health Serv. Hannover FSGD, Fish Dis. Res. Unit, Sch. Vet. Med. Bunteweg 17, D-3000 Hannover 71, Fed. Rep. Germany.).

001163.

000583

Schlotfeldt, H. J.

1979. Infectious pancreatic necrosis (IPN) of salmonids. Part II. Laboratory diagnostics. (Die infektiöse Pankreasnekrose (IPN) der Salmoniden. Teil II: Laboratoriumsdiagnostik.) *Tieraerztl. Umsch.* 9(1):599-605. (Fachtierarzt

fur Fische-Krankheiten, Fischkrankheiten-Bearbeitung, Inst. Virol. Tierarztl. Hochschule, Hannover, Fed. Rep. Germany.).

(Note: See also Part I, abstracted in Fish Health News 9(2):19, 1980. Translation of Part I into English is available as Aquaculture Translation No. 112; Part II as Aquaculture Translation No. 113. Xerox copies of the translations may be obtained by writing to Technical Information Service, National Fisheries Center, Route 3, Box 40A, Kearneysville, WV 25430). Current methods for the diagnosis of infectious pancreatic necrosis (IPN) of salmonids, by the isolation and identification of IPNV in various cell systems are discussed. The sensitivity of cells to IPNV are analyzed. Serological tests, including fluorescent techniques, are described. (Author). 001077. (Paper in German)

000584

Schneider, R., Nicholson, B. L.

1980. Bacteria associated with fin rot disease in hatchery-reared Atlantic salmon (*Salmo salar*). *Can. J. Fish. Aquat. Sci.* 37(10):1505-1513. (Dep. Microbiol. Migratory Fish Res. Inst. Univ. Maine, Orono, Maine 04469.).

Fin rot is a progressive necrotic disease of many fish species. Several bacteria have been implicated in the etiology of the disease. To determine the bacteria associated with the disease in Atlantic salmon, fish were randomly sampled at weekly intervals at two hatcheries from August 1977 to April 1978. The degree of fin rot was scored numerically by a standard method and bacteria were enumerated by plate count on several media. Representative colonies were isolated for identification. The extent and severity of fin rot increased as the water temperature decreased. The average total colony counts from healthy fins of fish at both hatcheries were low ( $2.5 \times 10^3$  per g) and included a variety of bacteria. The average total colony counts from fins with severe rot were high ( $2.0 \times 10^6$  per g) with one or more *Flexibacter* species and *Aeromonas salmonicida* accounting for 50-90% of the total. Statistical analysis showed a highly significant positive correlation of fin rot with *Aeromonas salmonicida* colony counts at hatchery I, whereas the disease was correlated only with *Flexibacter* colony counts at hatchery II. High colony counts of both *Flexibacter* sp. and *A. salmonicida* were correlated with low water temperatures at the respective hatcheries. Electron microscopical examination of fins with advanced lesions revealed evidence of tissue necrosis surrounding bacteria. Thus, while no relationship was observed between bacteria and the onset of fin rot disease, evidence was obtained implicating at least two species of bacteria as probable etiological



agents of the progressive disease. (Authors). 001078.

000585

Schulz, D.

1980. Erythrodermatitis of carp: studies of the mode of infection. Pages 137-144 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Div. Zoonoses Epizootics, Inst. Vet. Med. Federal Health Office, Postfach, D-1000 Berlin 33, Fed. Rep. Germany.).

001154.

000586

Schwedler, T. E., Plumb, J. A.

1980. Fish viruses: serologic comparison of the golden shiner and infectious pancreatic necrosis viruses. J. Wildl. Dis. 16(4):597-599. (Dep. Fish. Allied Aquacult. Auburn Univ. Agric. Exp. Stn. Auburn, Ala. 36830.).

High titer neutralizing antiserum to golden shiner virus (GSV) was produced in a rabbit. The GSV antiserum had significant neutralization indices in tests with the original strain of GSV and with another more recent isolate. Neutralization indices were not significant when two strains of infectious pancreatic necrosis virus (IPNV) were reacted with GSV antiserum, and neither isolate of GSV showed significant reactivity in neutralization tests with polyvalent IPNV antiserum. Our results indicate that IPNV and GSV are serologically unrelated. (Authors). 001001.

000587

Seagrave, C., Bucke, D., Alderman, D.

1980. The causative agent of proliferative kidney disease may be a member of the Haplosporidia. Pages 174-181 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Minist. Agric. Fish Food, Dir. Fish. Res. Fish Dis. Lab. Weymouth DT4 8UB, Dorset, England.).

001159

000588

Shimura, S., Egusa, S.

1980. Some ecological notes on the egg deposition of *Argulus coregoni* Thorell (Crustacea, Branchiura). Fish Pathol. 15(1):43-47. (Dep. Fish. Fac. Agric. Univ. Tokyo, Bunkyo-ku, Tokyo 113, Japan.).

Laboratory and field experiments were made to examine the effects of time of day, water depth, and roughness of substrata on the egg deposition of *Argulus coregoni*. Egg-laying occurred normally at night (98%, 93/95); however, mature females laid eggs even in the daytime under experimentally dark conditions. The oviposition was thus considered to be influenced by the absence of light.

The relationship between water depth and egg deposition was examined in trout ponds of 65 cm and 140 cm deep by hanging acrylic plates as substrata for the egg deposition, and the clusters of eggs deposited on the plates were analyzed. The clusters were found to be more abundant nearer the bottom of both ponds: 88% of the total number of clusters deposited at a depth of 45-65 cm in the pond of 65 cm depth and 74% at a depth of 100-140 cm in the 140 cm-deep pond.

The parasite showed a preference of roughness of substrata. Only a few egg clusters were deposited on transparent glass (smooth substratum of less than 0.5  $\mu$ m maximum height of roughness) and on a wooden plate (rough substratum of more than 50  $\mu$ m), whereas abundant egg clusters were found on frosted glass or unglazed tile with a roughness of about 9  $\mu$ m.

Methods of control of *A. coregoni* utilizing these results are also discussed. (Authors). 001032. (Paper in Japanese)

000589

Shiomitsu, K., Kusuda, R., Osuga, H., Muneakiyo, M.

1980. Studies on chemotherapy of fish disease with erythromycin-II. Its clinical studies against streptococcal infection in cultured yellowtails. Fish Pathol. 15(1):17-23. (Kagoshima Pref. Fish. Exp. Stn. Kagoshima, Japan.).

Efficacy of erythromycin (EM) against spontaneous streptococcal infection in cultured yellowtails *Seriola quinqueradiata* was evaluated clinically. The present studies given seven experiments were accomplished from August to October in 1978. The fish tested were 1st (80,500 fish) and 2nd (29,100 fish) year fish of cultured yellowtails being raised at fish farms in Kochi and Kagoshima prefectures.

All of the clinical isolates of *Streptococcus* sp. from naturally infected fish were susceptible to EM, tetracycline, ampicillin, and chloramphenicol, but resistant to sulfamonomethoxine. The minimal inhibitory concentration of EM ranged from 0.1 to 0.2 µg/ml and was the lowest in the tested drugs.

In the clinical studies, EM was mixed in minced mackerel or mackerel pikes with formula feed and a binder, and consecutively administered for 4-7 days at the dose of 25-50 mg/kg/day. The diseased fish, in every experiment, responded to EM with reduction in mortality and were found to be controlled of the disease during medication or within a few days post-dosing. The efficacy of EM against streptococcal infection was more remarkable than those of oxytetracycline (50-80 mg/kg/day) and ampicillin (20 mg/kg/day). EM was also effective against the disease which could not be cured by ampicillin.

The administration of EM caused no clinical abnormality in about 100,000 fish of cultured yellowtails. The results of the present study suggest that EM can be used for the control of streptococcal infection in cultured yellowtails. (Authors). 001052. (Paper in Japanese)

000590

Smith, P. D., McCarthy, D. H., Paterson, W. D.

1980. Further studies on furunculosis vaccination. Pages 113-119 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Dep. Bacteriol. Virol. Univ. Manchester, Oxford Rd. Manchester M13 9PT, England.).

001150.

000591

Solomon, D. J., Taylor, A. L.

1979. Critical factors in the transport of live freshwater fish — II. State of feeding and ammonia excretion. Fish. Manage. 10(2):81-85. (Salmon Freshw. Fish. Lab. Minist. Agric. Fish. Food, 10 Whitehall Place, London SW1A 2HH.).

The influence of recent feeding on fish under transport conditions is discussed, and a period of starvation before moving recommended. Problems of ammonia toxicity are described, and recommendations made for minimizing the risk. (Authors). 000959

000592

Sommerville, C.

1981. A comparative study of the tissue response to invasion and encystment by *Stephanochasmus baccatus* (Nicoll, 1907) (Digenea: Acanthocolpidae) in four species of flatfish. J. Fish Dis. 4(1):53-68. (Inst. Aquacult. Univ. Stirling, Stirling FK9 4LA, Scotland.).

Four species of flatfish (Plaice, *Pleuronectes platessa* L. turbot, *Scophthalmus maximus* (L. ); Dover sole, *Solea solea* (L. ) and the common dab, *Limanda limanda* (L. )) were experimentally infected with cercariae of *Stephanochasmus baccatus* under similar conditions and examined at intervals up to 7 weeks post infection. The tissue response was found to be qualitatively the same in all four hosts and was consistent with a chronic granulomatous inflammatory reaction induced by resistant particulate foreign bodies. The intensity and rate of the response varied between host species but the capsule formation was essentially similar in all. The mature capsule consisted of an inner layer composed of leucocytes which underwent epithelioid transformation. The cellular structure of this tissue gradually degenerated from the oldest layer to form a dense eosinophilic ground substance in which was embedded nuclear debris. The outer layer of the capsule consisted of fibroblasts and reticulin collagen fibers. Muscle and fin cysts differed, with muscle cysts tending to be less discrete and more fibrous. The rate and intensity of the response to the parasite varied between different host species. Plaice and turbot showed the most intensive response and in turbot the reaction was considerably accelerated. Mortality of encysted metacercariae was only seen in turbot. The overall effect on larger 1-group fish was minimal, but the smaller 0-group plaice were more severely affected by the relatively large cysts that interfered with organ function. (Author). 001126.

000593

Srivastava, R. C.

1980. Fungal parasites of certain fresh water fishes of India. Aquaculture 21(4):387-392. (Dep. Botany, S.M.M.Town P.G. Coll. Ballia, India.).

Twenty-one isolates of saprolegniaceous fungi representing three genera, viz. *Achlya*; *Aphanomyces*; and *Saprolegnia*, were isolated from 19 different species of fishes from Indian waters. The pathogenicity of these isolates has been tested by conducting artificial inoculation experiments under controlled laboratory conditions (proving

Koch's postulates) using *Anabas testudineus* Bl. and *Channa punctatus* Bl. as test fishes. (Author). 001000.

000594

Sugiyama, T., Ueki, N.

1979. On vibriosis of the cultured amago *Oncorhynchus rodurus*. Bull. Fish. Exp. Stn. Okayama Pref. 53(5):193-196. (Fish. Exp. Stn. Okayama Pref. Kashino, Ushimado, Okayama, Japan.).

001019. (Paper in Japanese)

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Sugiyama, T., Ueki, N.

1979. On fish diseases in Okayama Prefecture, 1978. Bull. Fish. Exp. Stn. Okayama Pref. 53(5):244-246. (Fish. Exp. Stn. Okayama Pref. Kashino, Ushimado, Okayama, Japan.).

001014. (Paper in Japanese)

000596

Sugiyama, T., Ueki, N.

1978. Studies on vaccination for vibriosis of the hatchery rearing young ayu-fish, *Plecoglossus altivelis* — on difference of effect of oral vaccine in rearing with freshwater and seawater. Bull. Fish. Exp. Stn. Okayama Pref. 52:195-198. (Fish. Exp. Stn. Okayama Pref. Kashino, Ushimado, Okayama, Japan.).

000961. (Paper in Japanese)

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Thune, R. L., Rogers, W. A.

1981. Gill lesions in bluegill, *Lepomis macrochirus* Rafinesque, infested with *Cleidodiscus robustus* Mueller, 1934 (Monogenea: Dactylogyridae). J. Fish Dis. 4(3):277-280. (Dep. Fish. Allied Aquacult. Alabama Agric. Exp. Stn. Auburn Univ. Auburn, Ala. 36830.).

Extensive hyperplasia of squamous cell epithelium was found to cover granulation tissue composed of fibroblasts and collagen fibers. Lamellae were grossly overgrown and although generally

well vascularized, necrosis was evident in less vascular areas. Well illustrated. (Ken Wolf). 001107.

000598

Timmons, T. J., Hemstreet, W. G.

1980. Prevalence rate of *Lernaea cyprinacea* L. (Copepoda: Lernaeidae) on young-of-the-year largemouth bass, *Micropterus salmoides* (Lacepede), in West Point Reservoir, Alabama-Georgia, U.S.A. J. Fish Dis. 3(6):529-530. (Dep. Fish. Allied Aquacult. Auburn Univ. Auburn, Ala. 36849.).

Monthly surveys involving capture of 1100 bass showed *Lernaea cyprinacea* to be most prevalent during early summer and to have a peak of 3.5% in June. Almost universally, fish had but one copepod, and the typical host was 50-74 mm long. Fish less than 25 mm or larger than 99 mm were not parasitized. The authors doubt that *L. cyprinacea* has any effect on bass growth or mortality. (Ken Wolf). 001004.

000599

Trust, T. J., Courtice, I. D., Atkinson, H. M.

1980. Hemagglutination properties of *Aeromonas*. Pages 218-223 in Ahne, W. ed. Fish diseases. Third COPRAQ Session. Springer-Verlag, Berlin. (Dep. Biochem. Microbiol. Univ. Victoria, Victoria, B. C. V8W 2Y2, Canada.).

001166.

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Ueki, N., Sugiyama, T.

1979. Mass mortality of cultured juvenile black sea bream *Mylio macrocephalus* in cold-water season-1. Influence of the gill-parasitic copepod *Clavellodes macrotrachelus*. Bull. Fish. Exp. Stn. Okayama Pref. 53(5):197-201. (Fish. Exp. Stn. Okayama Pref. Kashino, Ushimado, Okayama, Japan.).

001018. (Paper in Japanese)

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Ueki, N., Sugiyama, T.

1979. On a bacterially caused disease of the pond cultured ayu-fish, *Plecoglossus altivelis*. Bull. Fish. Exp. Stn. Okayama Pref. 53(5):202-204. (Fish. Exp. Stn. Okayama Pref. Kashino, Ushimado, Okayama, Japan.).

001017. (Paper in Japanese)

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Ueki, N., Sugiyama, T.

1979. On visceral mycosis of the hatchery reared young ayu-fish, *Plecoglossus altivelis*. Bull. Fish. Exp. Stn. Okayama Pref. 53(5):247-248. (Fish. Exp. Stn. Okayama Pref. Kashino, Ushimado, Okayama, Japan.).

001016. (Paper in Japanese)

000603

Urawa, S., Muroga, K., Kasahara, S.

1980. Studies on *Neoergasilus japonicus* (Copepoda: Ergasilidae), a parasite of freshwater fishes - II. Development in copepodid stage. J. Fac. Appl. Biol. Sci. Hiroshima Univ. 19(1):21-38. (Fac. Appl. Biol. Sci. Hiroshima Univ. Fukuyama, Japan.).

More than 1000 copepodid stage life forms were collected and analyzed. The life cycle has six nauplius stages, and five copepodid stages take place before transformation to the adult stage. Sex is first distinguishable at copepodid stage III and adulthood is reached at stage VI. After copulation the female becomes parasitic and the male either dies or remains free-living. Tabular data and numerous line drawings illustrate the report. (Ken Wolf). 001062.

000604

Urawa, S., Muroga, K., Kasahara, S.

1980. Naupliar development of *Neoergasilus japonicus* (Copepoda: Ergasilidae). Bull. Jpn. Soc. Sci. Fish. 46(8):941-947. (Fac. Appl. Biol. Sci. Hiroshima Univ. Fukuyama 720, Japan.).

*Neoergasilus japonicus* is a parasitic copepod which has been reported from various freshwater fishes in Asia and Europe.

In this study, a morphology of the species in nauplius stages is given from the results of a rearing experiment.

According to the molts, the naupliar development of the species was divided into six stages like typical free-living copepods. They are capable of feeding throughout all the stages. The first maxilla appears in stage IV, and the rudimental first and second legs in stage VI. The second maxilla and the maxilliped are never found in any of the stages.

The result was compared with the descriptions of six other species of Ergasilidae in their developmental courses of nauplius stages, and some suspicion was cast on the results of the past workers. (Authors). 001013.

000605

Valtonen, E. T.

1980. *Metechinorhynchus salmonis* infection and diet in the river-spawning whitefish of the Bothnian Bay. J. Fish Biol. 17(1):1-8. (Dep. Zool. Univ. Oulu, Finland.).

A total of 206 river-spawning whitefish *Coregonus lavaretus* (L.) from the Bothnian Bay was investigated for food objects and acanthocephalans in the years 1975-78. The only acanthocephalan species found was *Metechinorhynchus salmonis* (Muller 1780), the total number of which was 1295.

The whitefish is shown to be highly susceptible to infection by *M. salmonis*, with as many as 88.9% of specimens infected in a sample in June 1978, although the mean intensity was only 8.9 parasites per host. The river-spawning whitefish does not favor the intermediate host, *Pontoporeia affinis*, in its summer diet in the Bothnian Bay preferring to feed on eggs and molluscs, so that the incidence of *M. salmonis* infection decreases to 33.3% by the middle of summer. This is further reduced in the late summer by the fast associated with the migration to their upriver spawning grounds. The fact that the other acanthocephalan inhabiting the river-spawning whitefish in the southern Gulf of Bothnia, *Echinorhynchus gadi* Muller, 1776 is not to be found in the Bothnian Bay population suggests that the fish captured in spring have remained in the Bothnian Bay throughout the winter. (Author). 001053



000606

Van Damme, L. R. . Vandepitte, J.

1980. Frequent isolation of *Edwardsiella tarda* and *Plesiomonas shigelloides* from healthy Zairese freshwater fish: a possible source of sporadic diarrhea in the tropics. Appl. Environ. Microbiol. 39(3):475-479. (Lab. Vet. ONDE, Kinshasa, Zaire.).

The intestinal contents of 59 Zairese freshwater fish were examined for the presence of potential human enteric pathogens. *Edwardsiella tarda* and *Plesiomonas shigelloides* were isolated from 57 and 59% of them, respectively. For both microorganisms there was a significant difference between the isolation rates from lake and river fish; whereas *E. tarda* was much more frequently isolated from lake fish than was *P. shigelloides*, the reverse was observed for river fish. The authors hypothesize that sporadic cases of tropical diarrhea with *E. tarda* or *P. shigelloides* can be traced to contact with or consumption of freshwater fish. (Authors). 001071.

000607

Wakabayashi, H., Egusa, S.

1979. What is the best organ for the isolation of eel-pathogens.. Fish Pathol. 13(4):201-203. (Dep. Fish. Fac. Agric. Univ. Tokyo, Bunkyo-ku, Tokyo, Japan.).

A bacteriological examination of internal organs of diseased eels cultured in the Yoshida Region showed that the apparent incidence of eels infected with bacterial pathogens depended on the organs examined. A total of 96 eels carried pathogens such as *Aeromonas hydrophila*, *Edwardsiella tarda*, and *Pseudomonas anguilliseptica* in heart (blood), spleen, liver, or kidney. The incidence of eels with these bacterias was 77% in heart (blood), 84% in spleen, 89% in liver, and 94% in kidney. (Authors). 000965. (Paper in Japanese)

000608

Wakabayashi, H., Egusa S., Fryer, J. L.

1980. Characteristics of filamentous bacteria isolated from a gill disease of salmonids. Can. J. Fish. Aquat. Sci. 37(10):1499-1504. (Dep. Fish. Fac. Agric. Univ. Tokyo, Bunkyo-ku, Tokyo 113, Japan.).

The morphological, physiological, and serological characteristics of 15 cultures of filamentous bacteria isolated in Japan (five isolates) and Oregon

from cultured salmonids suffering from bacterial gill disease were determined and compared. The strains from each area were uniform in characteristics and apart from minor differences in temperature and salinity tolerances, each geographic group of isolates was physiologically similar. Serologically, however, although all strains possessed a common antigen, the Japanese and Oregon strains were distinct. It was found that all strains could readily colonize the gill epithelium of juvenile rainbow trout causing an asymptomatic infection, but in some experiments fatal gill disease was irregularly produced. (Authors). 001064.

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Walters, G. R., Plumb, J. A.

1980. Environmental stress and bacterial infection in channel catfish, *Ictalurus punctatus* Rafinesque. J. Fish Biol. 17(2):177-185. (Dep. Fish. Allied Aquacult. Alabama Agric. Exp. Stn. Auburn Univ, Auburn, Ala. 36830.).

Channel catfish, *Ictalurus punctatus*, were injected intraperitoneally with a sublethal dose of *Aeromonas hydrophila* and then stressed for 144 h by being maintained either in a dissolved oxygen concentration of 1.5 mg per liter, 1.2 mg per liter total ammonia, and/or 6.5 mg per liter free CO<sub>2</sub> with a continuous inflow of water. A significant difference in percentage of mortality was noted between treatments ( $P < 0.05$ ). The trunk kidneys of surviving stressed fish had significantly higher total bacterial counts than nonstressed controls. *Aeromonas hydrophila* was isolated from 67% of the stressed fish and 9% of the control fish. *Edwardsiella tarda*, apparently endemic in the population, was isolated from 43% of the stressed fish and 7% of the control fish. Histopathological lesions were in the gills, liver, spleen, trunk kidney, and head kidney of stressed fish, but not control fish. (Authors). 001029.

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Winton, J.

1979. The diagnosis and identification of bacterial fish pathogens. Pages 25-28 in J. L. Fryer, J. S. Rohovec, E. F. Pulford, R. E. Olson, D. P. Ransom, J. R. Winton, C. N. Lannan, R. P. Hedrick, and W. J. Groberg, eds. Proceedings from a conference on disease inspection and certification of fish and fish eggs. Oreg. State Univ. Sea Grant Coll. Progr. (Dep. Microbiol. Oregon State Univ. Corvallis, Oreg. 97331.).



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Yamamoto, S.

1979. Effects of the diets of supplemental vitamin C and phosphatic salts for the survival, growth and anomalies of larvae ayu fish, *Plecoglossus altivelis*. Bull. Fish. Exp. Stn. Okayama Pref. 53(5):230. (Fish. Exp. Stn. Okayama Pref. Kashino, Ushimado, Okayama, Japan.).

001015. (Paper in Japanese)

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Zdzitowiecki, K.

1979. Digenetic trematodes in alimentary tracts of fishes of South Georgia and South Shetlands (Antarctica). (Przywry z przewodu pokarmowego ryb z okolic Południowej Georgii i Południowych Szetlandów (Antarktyka).) Acta Ichthyol. Piscatoria 9(1):15-31. (Zakład Parazytol. Polskiej Akademii Nauk, Pasteura 3 s.p. 153, 00-973 Warsaw, Poland.).

Digenetic trematodes were found in 30 fish individuals out of 46 examined from catches obtained off South Shetlands, while off South Georgia all 16 individuals examined were found to contain the parasites. The same 7 parasitic species were found in the two areas, *Elytrophalloides oatesi* prevailing off South Georgia and *Plagioporus pennelli* and *Genolinea bowersi* off South Shetlands. The remaining species included: *Lecithaster australis*, *Gonocerca phycidis*, *Lepidapedon antarcticus*, and *Neolebouria georgiensis*. The descriptions of *L. antarcticus*, *L. australis* and *G. bowersi* are given along with a number of supplementary remarks concerning morphology of the remaining species found. (Author). 001065.

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Aaronson, M. J., Kirby, K. W., Tessari, J. D.

1980. Identification and confirmation of atrazine in pond water. Bull. Environ. Contam. Toxicol. 25(3):492-497. (Colorado Epidemiol. Pestic. Stud. Cent. Coll. Vet. Med. Biomed. Sci. Inst. Rural Environ. Health, Colo. State Univ. Fort Collins, Colo. 80523.).

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Abo-Rady, M. D. K.

1979. Determination of mercury in water, fish, plant and sediment samples by atomic-absorption spectroscopy. (Quecksilberbestimmung in Wasser-, Fisch-, Pflanzen- und Sedimentproben mit Hilfe der Atom-Absorptions-Spektroskopie.) Fresenius Z. Anal. Chem 299:187-189. (Inst. Physische Geo. Senckenberganlage 36, D-6000 Frankfurt/Main, Fed. Rep. Germany.).

001060. (Paper in German)

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Broyles, R. H., Noveck, M. I.

1979. Uptake and distribution of 2,4,5,2',4',5'-hexachlorobiphenyl in fry of lake trout and chinook salmon and its effects on viability. Toxicol. Appl. Pharmacol. 50:299-308. (Dep. Zool. Cent. Great Lakes Studies, Univ. Wis. -- Milwaukee, Milwaukee, Wis. 53201.).

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Broyles, R. H., Noveck, M. I.

1979. Uptake and distribution of 2,5,2'5'-tetrachlorobiphenyl in developing lake trout. Toxicol. Appl. Pharmacol. 50:291-298. (Dep. Zool. Cent. Great Lakes Studies, Univ. Wis. -- Milwaukee, Milwaukee, Wis. 53201.).

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Burton, D. T.

1980. Evaluation of Pentrol D-90 toxicity to juvenile estuarine fish and blue crabs. Bull. Environ. Contam. Toxicol. 25(3):470-476. (Acad. Nat. Sci. Philadelphia, Benedict Estuarine Res. Lab. Benedict, Md. 20612.).

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Carroll, J. J., Ellis, S. J., Oliver, W. S.

1979. Influences of hardness constituents on the acute toxicity of cadmium to brook trout (*Salvelinus fontinalis*). Bull. Environ. Contam. Toxicol. 22(4,5):575-581. (U.S. Environ. Prot. Agency, Off. Water Waste Manage. Washington, D. C. 20460.).

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Cizek, V., Svobodova, Z.

1980. The effect of organophosphoric pesticides to fish (review). (Vliv organofosforecnych pesticidu na ryby (prehled).) Bul. VURH Vodnany 3(16):21-28. (Fish. Res. Inst. Vodnany, Czechoslovakia.).

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Dinnel, P. A., Stober, Q. J., DiJulio, D. H.

1979. Behavioral responses of shiner perch to chlorinated primary sewage effluent. Bull. Environ. Contam. Toxicol. 22(4,5):708-714. (Fish. Res. Inst. Univ. Washington, Seattle, Wash. 98195.).

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Eurell, J. A., Haensly, W. E.  
1981. The effects of exposure to water soluble fractions of crude oil on selected histochemical parameters of the liver of Atlantic croaker, *Micropogon undulatus* L. J. Fish Dis. 4(3):187-194. (Dep. Vet. Anat. Texas A&M Univ. College Station, Tex. 77840.).  
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Fingerman, S. W., Russell, L. C.  
1980. Effects of the polychlorinated biphenyl Aroclor 1242 on locomotor activity and on the neurotransmitters dopamine and norepinephrine in the brain of the gulf killifish, *Fundulus grandis*. Bull. Environ. Contam. Toxicol. 25(4):682-687. (Dep. Biol. Tulane Univ. New Orleans, La. 70118.).  
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Finlayson, B. J.  
1980. Acute toxicities of the herbicides Komeen and Hydrothol-191 to golden shiner (*Notemigonus crysoleucas*). Bull. Environ. Contam. Toxicol. 25(4):676-681. (California Dep. Fish Game, Pestic. Invest. Unit, Water Pollut. Control Lab. 987 Jed Smith Drive, Sacramento, Calif. 95819.).  
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Graves, W. C., Burton, D. T., Richardson, L. B.  
1980. Effect of 20- to 30-day continuous exposure of treated bleached kraft mill effluent on selected freshwater species. Bull. Environ. Contam. Toxicol. 25(4):651-657. (Acad. Natu. Sci. Philadelphia, Benedict Estuarine Res. Lab. Benedict, Md. 20612.).
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Hata, K., Kaneda, T.  
1980. Effect of autoxidized oil on carp. Bull. Jpn. Soc. Sci. Fish. 46(8):997-1000. (Dep. Food Chem. Fac. Agric. Tohoku Univ. Amamiyama, Tsutsumidori, Sendai 980, Japan.).  
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Hinton, M. J., Eversole, A. G.  
1980. Toxicity and tolerance studies with yellow-phase eels: five chemicals. Prog. Fish-Cult. 42(4):201-203. (Dep. Entomol. Econ. Zool. Clemson Univ. Clemson, S. C. 29631.).  
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Huey, D. W., Simco, B. A., Criswell, D. W.  
1980. Nitrite-induced methemoglobin formation in channel catfish. Trans. Am. Fish. Soc. 109(5):558-562. (Ecol. Res. Cent. Dep. Biol. Memphis State Univ. Memphis, Tenn. 38152.).  
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Jay, F. B., Muncy, R. J.  
1979. Toxicity to channel catfish of wastewater from an Iowa coal beneficiation plant. Iowa State J. Sci. 54(1):45-50. (Water-Treatment Plant, Ventura, Calif. 93003.).  
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Johnson, W. W., Finley, M. T.  
1980. Handbook of acute toxicity of chemicals to fish and aquatic invertebrates. Summaries of toxicity tests conducted at Columbia National Fisheries Research Laboratory, 1965-78. U.S. Fish Wildl. Serv. Resour. Publ. 137, 1980. 98 pp.

(U.S. Fish Wildl. Serv. Columbia Natl. Fish. Res. Lab. Columbia, Mo. 65201.).

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Jurkowski, M. K.

1979. The effect of DBS on survival of juvenile perch (*Perca fluviatilis* L.) in relation to certain physical factors. (Wplyw detergentu DBS na przezywalnosc narybku okonia (*Perca fluviatilis* L.) w zaleznosci od niektorych czynnikow fizycznych.) Acta Ichthyol. Piscatoria 9(2):55-61. (Zaklad Fizjologii, Akademii Medycznej, 80-211 Gdansk, ul. Debinki 1, Poland.).

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Jurkowski, M. K., Stachowiak, M., Bialowas, J. W.

1979. Effects of certain stress situations and of DBS on acetylcholinesterase, acetylcholinesterase, and monoamineoxidase activities in various regions of brain of juvenile carp, (*Cyprinus carpio* L.). (Wplyw niektorych sytuacji stresowych i detergentu (DBS) na aktywnosc acetylcholinotransferazy, acetylcholinoesterazy i monoaminooksydazy w poszczegolnych czesciach mozgowia narybku karpia (*Cyprinus carpio* L.).) Acta Ichthyol. Piscatoria 9(2):21-29. (Inst. Biol. Med. Akad. Med. Gdansku, 80-211 Gdansk, Poland.).

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Kasuga, S.

1980. Sexual differences of medaka, *Oryzias latipes* in the acute toxicity test of cadmium. Bull. Jpn. Soc. Sci. Fish. 46(9):1073-1076. (Environ. Biol. Div. Natl. Inst. Environ. Studies, Yatabe, Ibaraki 305, Japan.).

001026. (Paper in Japanese)

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Kawatsu, H.

1980. Hematological characteristics of molinate anemia in common carp. Bull. Jpn. Soc. Sci. Fish. 46(9):1103-1107. (Fac. Agric. Miyazaki Univ. 210 Funatsuka-3, Miyazaki 880, Japan.).

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Kepr, T., Adamek, Z.

1980. Herbicide toxicity to fish: carboxylic acid-based herbicides. (Toxicita herbicidu na bazi chlorovanych karboxylovych kyselin pro ryby.) Bul. VURH Vodnany 3(16):16-20. (Vyzkumny ustav rybarsky a hydrobiologicky, 389 25 Vodnany, Czechoslovakia.).

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Kobayashi, K., Akitake, H., Manabe, K.

1979. Relation between toxicity and accumulation of various chlorophenols in goldfish. Bull. Jpn. Soc. Sci. Fish. 45(2):173-175. (Lab. Fish. Chem. Fac. Agric. Kyushu Univ. Fukuoka, Japan.).

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Kubota, S. S., Ochiai, T., Akeda, S.

1981. Ultrastructural study of inclusion like bodies in hepatocytes of *Cyprinus carpio* L. induced by the herbicide Benthicarb. J. Fish Dis. 4(1):77-81. (Fac. Fish. Mie Univ. Tsu, Mie Pref. Japan.).

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Larsson, A., Lehtinen, K. J., Haux, C.

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Markarian, R. K., Matthews, M. C., Connor, L. T.

1980. Toxicity of nickel, copper, zinc and aluminum mixtures to the white sucker (*Catostomus commersoni*). Bull. Environ. Contam. Toxicol. 25(5):790-796. (Bio-dynamics Inc. East Millstone, N. J. 08873.).

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McCann, J. A., Hitch, R. K.

1980. Simazine toxicity to fingerling striped bass. Prog. Fish-Cult. 42(3):180-181. (U.S. Environ. Prot. Agency, Off. Pestic. Programs, Bldg. 288, ARC-East, Beltsville, Md. 20705.).

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Meade, T. L., Perrone, S. J.

1980. Effect of chloride ion concentration and pH on the transport of nitrite across the gill epithelia of coho salmon. Prog. Fish-Cult. 42(2):71-72. (Dep. Anim. Sci. Coll. Resour. Dev. Univ. Rhode Island, Kingston, R. I. 02881.).

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Muramoto, S.

1980. Decrease in cadmium concentration in a Cd-contaminated fish by short-term exposure to EDTA. Bull. Environ. Contam. Toxicol. 25(5):828-831. (Inst. Agric. Biol. Sci. Okayama Univ. 2-20-1 Chu-o, Kurashiki, 710 Japan.).

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Ozoh, P. T. E.

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Phillipson, D. W., Puma, B. J.

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Ultsch, G. R., Ott, M. E., Heisler, N.

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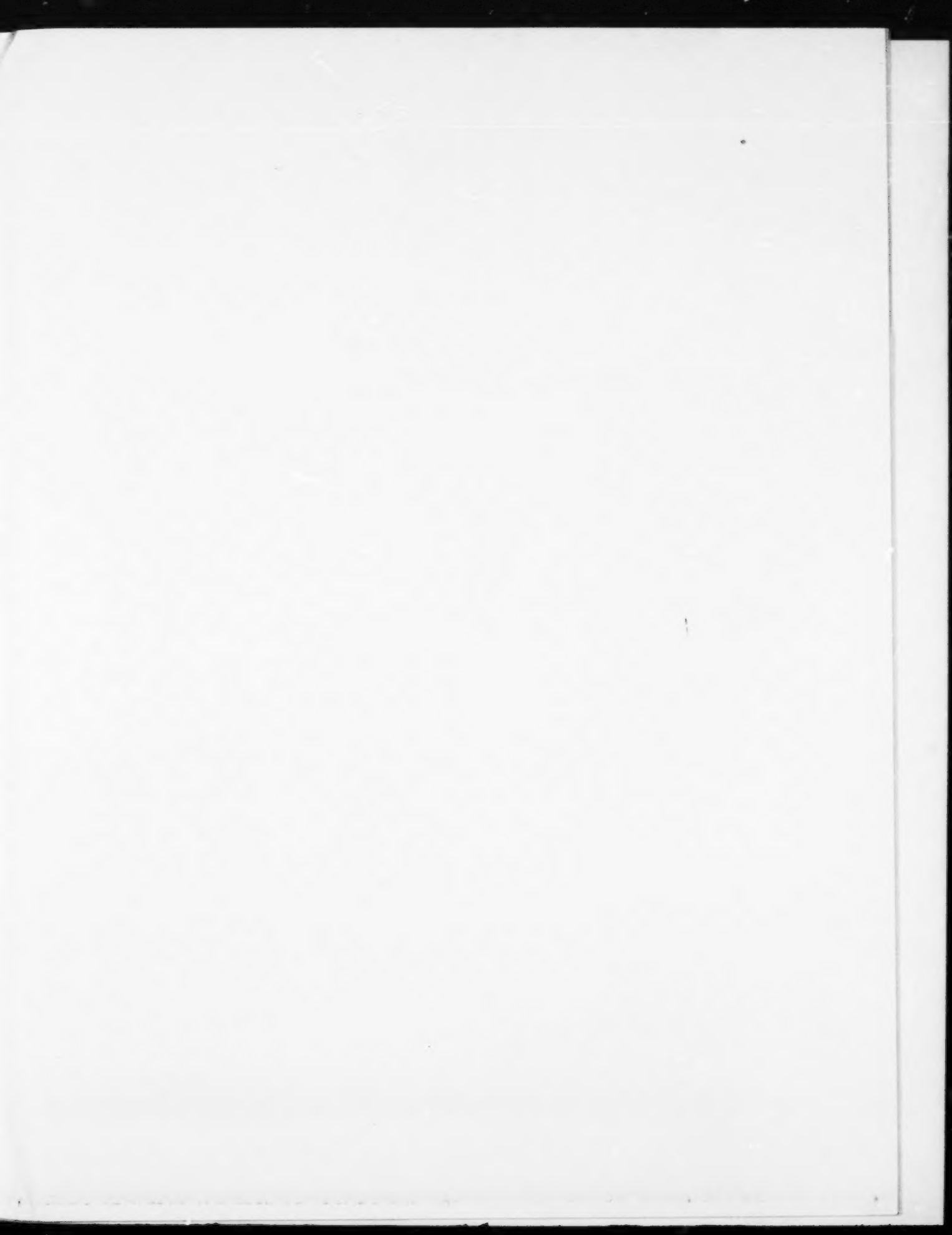
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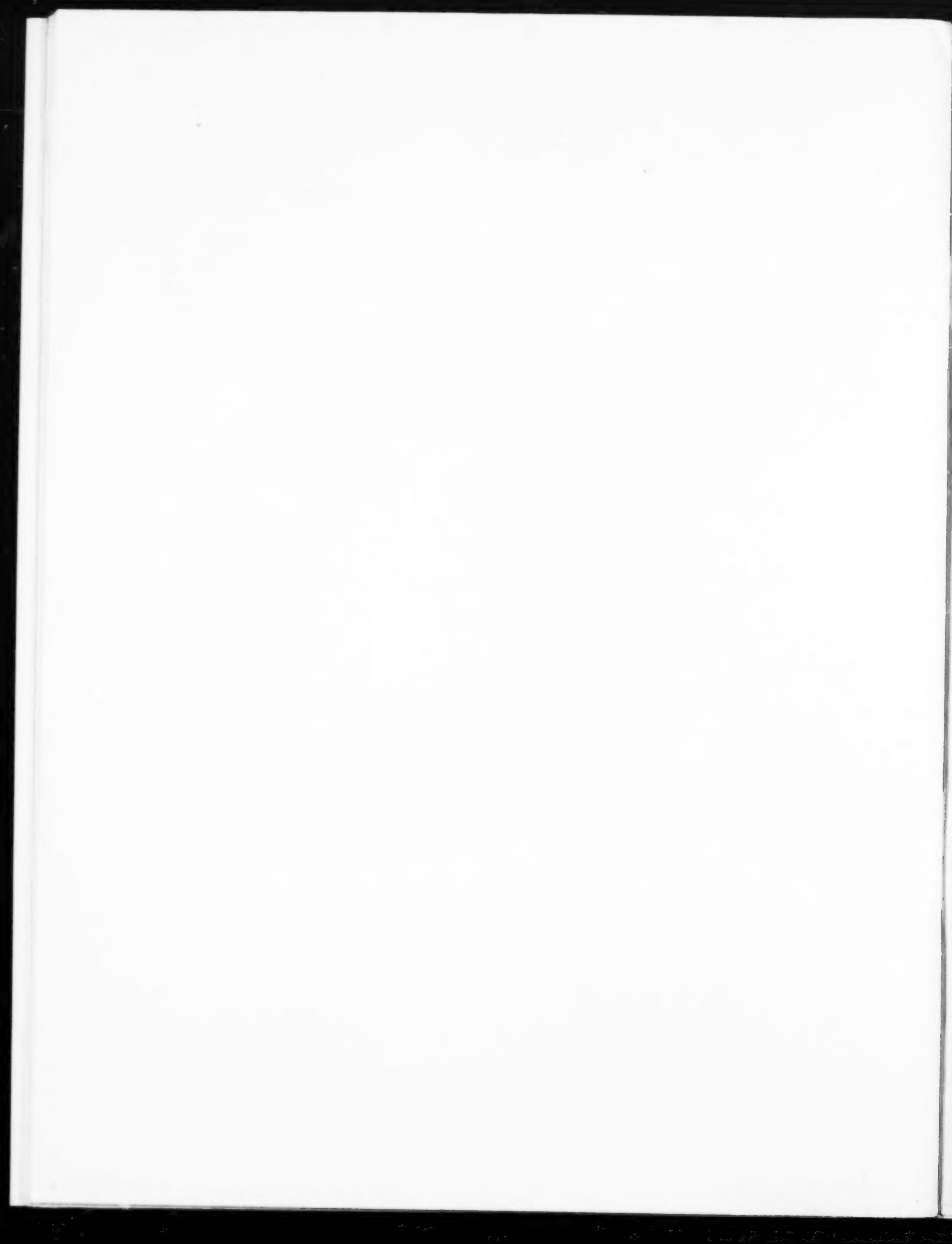
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